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VOLUME 8 NUMBER 14

THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

AUGUST 1989

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The Austin 286/20 Cache includes a VGA color monitor, 16 bit VGA color adapter, 40 MB-28 ms 1:1 hard drive, GE 1 year on-site service, 1 MB RAM, shadow RAM cache, Super PC Kwik disk cache software, 1.2 MB 5 1/4" floppy drive, 101 keyboard, and a full array of I/O ports.

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The Austin 386/20 Cache includes a 64K static RAM cache, VGA color monitor, 16 bit VGA color adapter, 72 MB-28 ms 1:1 hard drive, GE 1 year on-site service, 1 MB RAM, Super PC Kwik disk cache software, 1.2 MB 5 1/4" floppy drive, 101 keyboard, and a full array of I/O ports.

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	110 MB-28 ms 1:1	\$2245	\$2000	\$2495
286/20	40 MB-28 ms 1:1	\$2135	\$2000	\$2495
	110 MB-28 ms 1:1	\$2245	\$2000	\$2495
386/SX	40 MB-28 ms 1:1	\$2135	\$2000	\$2495
	110 MB-28 ms 1:1	\$2245	\$2000	\$2495
386/20	40 MB-28 ms 1:1	\$2135	\$2000	\$2495
	110 MB-28 ms 1:1	\$2245	\$2000	\$2495
386/33	40 MB-28 ms 1:1	\$2135	\$2000	\$2495
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# Several steps faster than the competition.


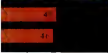
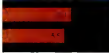
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\*MIPS benchmarks based on The Database Group Power Meter MIPS version 1.2.

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# *Enable/OA overcomes the obstacles to true office automation.*

If you start automating your office by looking at software, you may find yourself in a labyrinth. Start instead by looking at your office. What do you want your computer system to do?

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These are the tools that bring people and tasks together and move data the way you want to move it, with greater productivity. It's called multitasking. And that's what Enable/OA will do.

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## **Enable/OA lets you customize**

The Enable/OA menu generator will customize your system. Macro facilities let you record keystrokes and commands as you use them to simplify complex tasks and applications.

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## **Easy to learn, easy to use**

All applications use the same commands and menus. On-screen help is complemented by complete, hypertext-generated documentation you can access any time—especially handy for laptop users.

## **Office automation with Enable/OA means:**

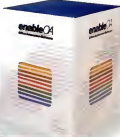
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- Comprehensive, professional reports
- Uninterrupted data flow
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the job better.**



# Letters

## KNOW YOUR ENGINE

Alfred Poor deserves high praise for a very thorough evaluation of LaserJet II add-in boards ("Add-in Boards for the HP LaserJet: Post-Purchase PostScript," *PC Magazine*, April 11, 1989).

The installation procedure for the Eicon board, though, is not nearly as difficult as Mr. Poor would have us believe and should not detract from what is otherwise a very good product. In my opinion, he should have been able to make the proper choice between the HP LaserJet II and a 300-dot-per-inch SX engine. I do agree, however, that Eicon should call the latter a "bare" or "controllerless" engine.

Ross Smith  
Santa Rosa, California

## SIGN LANGUAGE:

### MORE THAN A SIMPLE GESTURE

I was initially pleased to see your review of *Sign Language Quiz* (After Hours, *PC Magazine*, May 16, 1989). However, I was dismayed to see the reviewer, Paula Seefeldt, equate learning the manual alphabet, the numbers one to ten, and "simple words" with learning American Sign Language.

Both as a hearing person who has worked closely with the hearing-impaired community and as a microcomputer application manager, I feel qualified to alert your readers to the fallacy of this statement. Almost all American Sign Language "words" involve not only hand motion but also body language and facial expression. American Sign Language has its own grammar and syntax, but is not simply English translated into motions. Learning to fingerspell "d-o-g" is not the same as learning the sign for dog, which is a snap of the middle finger against the thumb followed by a slap on the thigh. American Sign Language no more requires fingerspelling everything than English requires us to speak in alphabet: "S-e-e S-p-o-t-u-n."

Ellen L. Bouwkamp  
Rockville, Maryland



"Editor's Choices: valid or void?"

## CONSERVE EDITOR'S CHOICES

I am a scientist and intensive PC programmer who wants to thank you for finally addressing the much-neglected area of PC programs specifically designed for scientific users, especially plotting packages ("Scientific Graphing: Two-Dimensional Plotting," *PC Magazine*, March 14, 1989).

However, how could you award the Editor's Choice to *Grapher* and *SigmaPlot*? These programs, while inarguably the best you dug up, simply do not cut the mustard. You should withhold this award until something better comes along.

The article glosses over the fact that neither program allows direct importation of Lotus-compatible worksheets. Technical PC users are crying out for this capability in a scientific plotting utility!

I am beginning to worry that *PC Magazine* is becoming an advocate for the industry rather than a voice crying out for what users really need. If this happens, you will lose the unique position of respect you have gained among more-sophisticated PC users. The Editor's Choice, likewise, is in real danger of becoming as hollow and meaningless as automobile

advertisements for "Car of the Year in Its Class" in myriads of publications.

Walter F. Kailey  
Lafayette, Colorado

## SHEDDING SOME LITE

I want to extend some kudos and billets-doux for LITES.COM. The new version works perfectly.

I was having a problem with a clone computer that had an old Diablo; I could not get it to print. None of my computer-literate friends could help, not even the supplier who sold it to me. I ran LITES.COM and discovered that the Diablo was not asserting Clear to Send (CTS). Rather, the computer was asserting Data Terminal Ready (DTR); the printer, Data Set Ready (DSR); the computer, Ready to Send (RTS); but no CTS ever went high. I then had a cable made tying CTS to RTS from the computer, and bingo!

Now I don't have to buy a breakout box, and I got a serial communications education along the way.

Vern Semrad  
Tampa, Florida

## AN EXCEL-LENT TIP

Thanks for running the article on Microsoft Excel ("25 Shortcuts to the Power of Excel," *PC Magazine*, March 28, 1989). But I'd like to suggest a better way to select large print areas (tip 12).

Usually, when I am setting a print area, I actually inspect (view) the lower-right corner to make sure that I know what the boundary is. Most people I watch do it this way. If you select the print area from the lower-right corner, then you can use the technique described in tip 12 to "goto" the known upper-left corner. That works fine.

However, there is a faster way that can be used when the upper-left corner of the print area is "home" (A1), as is frequently the case. With the cursor in the lower-right corner, press Shift-Ctrl-Home, and the area is selected in a flash.

Ron D. White  
Denver, Colorado

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## Letters

### ANOTHER HELPFUL HINT

In the sidebar, "Downshifting Your Drives," ("Driver's Ed: Choosing and Installing a 3 1/2-inch Drive," *PC Magazine*, April 25, 1989), the use of the DOS 3.3 format /N/9 /T:80 as a means of formatting 720K disks in a 1.44MB 3 1/2-inch drive is recommended. No mention was made of the fact that you can use the same command switch with a 1.2MB 5 1/4-inch drive, pop in a regular double-sided double-density disk, and format it as a 720K 5 1/4-inch disk. This procedure does work. I've tried it and had no bad sectors—and no problems writing 80 tracks on them provided that no track has more than nine sectors.

With versions of DOS prior to 3.2, however, caution is advised. Since DOS 3.0 and 3.1 do not support 3 1/2-inch disks at all, these versions appear to think that a 720K 5 1/4-inch disk is a high-density disk with lots of bad sectors. How well 720K disks will work with DOS 3.0 and 3.1 is unpredictable and may not be worth the risk involved.

Arthur Stoppel  
Moorestown, New Jersey

### MYTH VS. LAW

William Zachmann perpetuates an ongoing myth in the computer industry: to wit, that computer languages are not subject to copyright laws (William F. Zachmann, *PC Magazine*, May 16, 1989). This is completely untrue. PL/1 and Ada are two examples of languages explicitly protected by copyrights. More important, the new federal copyright statutes protect any written work even if no formal filing has taken place.

Those who write about the law should learn it first.  
Tony Lime  
San Carlos, California

### EDITORS ARE HUMAN TWO

Stephen Manes's headline "Electronic Paper: Is That 'Gum' or 'Gub'?" (*Stephen Manes, PC Magazine*, April 25, 1989) is evidence that given today's reliance on spell-checkers, a course in electronic penmanship may not be such a bad idea.

If you replace the word "gum" with "gun," the headline becomes a reference to the scene in Woody Allen's *Take the*

*Money and Run*, in which an attempted bank robbery is foiled because the note that Allen's character has passed the teller is illegible. ("What's a gub?" the teller asks blankly.)

An error of this sort, in which one word is substituted for another, can only be

**William Zachmann  
perpetuates an ongoing  
myth in the computer  
industry that computer  
languages are not  
subject to copyright  
laws. PL/1 and Ada  
are two languages that  
are copyrighted.**

caught by careful review and familiarity with the subject under discussion. For this reason, spell-checkers don't threaten the job security of human editors.

Joan S. Abrams  
Cambridge, Massachusetts

### P.S. YOU FORGOT THE MODEL 70

In your article on file transfer software ("File Transfer Software: Building Bridges Between Machines," *PC Magazine*, April 25, 1989), no mention was made of a problem that arises in using file transfer software when one of the PCs connected by a serial port is an IBM PS/2 Model 70.

Both Traveling Software, maker of *Lap-Link Plus*, and White Crane Systems, publisher of *The Brooklyn Bridge*, have indicated that I can use their software packages only at a maximum of 38,400 bits per second (as compared with the maximum rate of 115,200 bps allowed by both packages) because IBM uses a different chip to control the serial port on the PS/2 Model 70. In fact, IBM told me that it does not support the serial port at a speed faster than 19,200 bps.

It is ironic that IBM's fastest machines are capable of performing file transfers only when using standard commercial prod-

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# Central Fidelity Is Banking On AT&T Computers.

*Left to Right:  
Dean Dodrill,  
AT&T Area Technical Manager*

*Jay Livingston,  
Corporate Executive Officer,  
Central Fidelity Bank,  
Richmond, Virginia*



Richmond, Virginia  
February 2, 1989

Central Fidelity Bank is among the nation's top 100 commercial banks with \$4.8 billion in assets. Looking to extend its fourteen-year record earnings streak, the bank commissioned its data processing division to deliver a vital strategic initiative, improve productivity, enhance sales opportunities, and provide faster customer service in the bank's nearly two hundred branch offices. Jay Livingston met recently with Dean Dondill of AT&T to review their work together.

**Jay:** Service is what bank customers expect. Faster service improves customer satisfaction and leads to more profitable relationships. When you speed up service, everyone is more productive, and we can spend more time with customers selling the bank's financial products.

**Dean:** Service and selling both depend on information. Our challenge was to provide the branches with rapid access to customer information and present that information to branch personnel in the most meaningful way. This could only be accomplished with a distributed, networked computing approach.

**Jay:** That's right. Our first priority was service and sales support in our branches, which meant fast, accurate retrieval and dispersal of information was crucial. AT&T's banking architecture provided that.

**Dean:** Early on, you talked about cost-effectiveness, return on investment, and a strategy for future growth and functionality. Remember that?

**Jay:** With an emphasis on profitability. We had major investments in existing systems and a lot of branches. AT&T's open systems approach didn't require trade-offs or expensive host additions, which is one of the rea-

sons you got the business. AT&T's creative alternatives surprised us.

**Dean:** The ease of networking AT&T WGS computers was fundamental to our proposal. We delivered maximum functionality, flexibility, and reliability to every workstation in each branch.

**Jay:** And StarLAN was a terrific way to connect and share branch resources. You made the most of our assets, including the intangible ones.

**Dean:** Like your customer databases—we found ways to further develop relationships with existing customers. The applications development tools we built saved time for your developers. New products and services can now be added quickly to both platform and teller software, so service and sales can continually improve.

**Jay:** Every bank employee associated with this system has become more productive. In my twenty-three years of banking, I've never seen a vendor provide such high-quality service and support. Central Fidelity Bank and AT&T are well positioned for the future.

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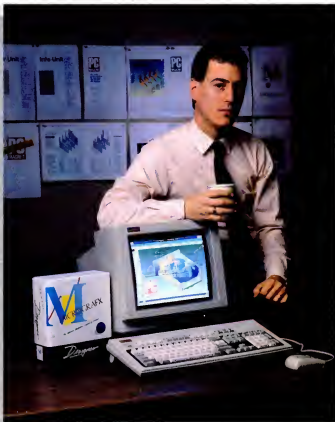
AGE: "31, last March."

PROFESSION: Artist & Designer.  
Director of Design & Electronic  
Publishing, *PC Magazine*.CREDITS: Gerard's designs, both  
traditional and electronic, have  
graced publications from *Personal  
Computing* to *Business Week*.LATEST PROJECT: Author of  
*Graphic Design in PostScript*,®  
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Illustrations by Gary Kepner  
Micrografx Designer was used extensively  
in producing PC Magazine's new look. Many of the  
illustrations in this issue were done with Designer.



Gerard Kunkel, Director of Design & Electronic Publishing, Designer Inc.

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## Letters

ucts such as *Lap-Link* or *Brooklyn Bridge* at one-quarter the speed of most commercial compatibles.

Harry Geist  
New York, New York

### OPINIONS COUNT

Almost every business does opinion research, either in the marketing or personnel/human resources department. I was somewhat pleased to see a brief

**Why has IBM waited  
to introduce a video  
card with built-in  
graphics primitives?**

mention of survey programs in your issue on statistical analysis packages ("Inside the World of Numbers," *PC Magazine*, March 14, 1989).

Good specialized survey software is as different from generalized statistical packages as a spreadsheet is from a database program—although they are often classed together. We would love to see an issue on survey software.

R. Kent Francis  
Alpine, Utah

### HEY IBM, WHAT'S NEXT?

As a graduate student at SMU, I recently had the opportunity to attend a demonstration of the NeXT computer. Needless to say, it had some unique and remarkable features. I was particularly impressed with its Display PostScript and its sound capabilities. And having individual processors for each I/O port seems a logical step forward.

Why hasn't IBM implemented such features on its PCs, and why has it waited so long to introduce a video card that has graphics primitives built into the hardware? These steps would be logical advances for microcomputers and would help IBM maintain its role as a standards setter, too.

David Daniel  
Dallas, Texas

### CORRECTIONS/AMPLIFICATIONS

The Overland Data TX-8 nine-track tape interface board ("To Mainframe and Back: Data Transfer by Nine-Track Tape," *PC Magazine*, April 25, 1989) transfers data 8 bits at a time, not 16 bits as reported. Nevertheless, its use of block I/O results in faster data transfers than DMA-based AT designs, either 8- or 16-bit.

J. P. Software's *4DOS* (First Looks, *PC Magazine*, May 16, 1989, page 54) is in fact a shareware program. Its licensing agreement permits users to try *4DOS* only for a limited time to decide whether or not it is suitable. After the evaluation period, the user must either pay for the program or stop using it.

The correct telephone number for SymSoft, developer of *HotShot Graphics* ("Crossing Format Frontiers: Low-Hassle Solutions to Data Transfer," *PC Magazine*, April 25, 1989), is (415) 941-1552.

The correct telephone number for LaserMaster Corp., maker of LaserMaster LX6 (First Looks, *PC Magazine*, May 16, 1989, page 46), is (612) 944-6069.

The telephone number of FoundationWare, maker of *Certus* ("Infection Protection," *PC Magazine*, April 25, 1989), has been changed to (216) 752-8181. Its toll-free number is (800) PC-CURES.

The photo/illustration on page 185 in the July 1989 issue ("SuperCalc5: Major Overhaul for a Long-time Contender," *PC Magazine*, July 1989) was created by Jook Leung.

### HOW TO WRITE TO PC MAGAZINE

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— Computer Shopper, April 1989

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w/80MB (28ms) & 1:1 Interleave	\$2849	\$2898	\$3048	\$3348
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— Computer Shopper, April 1989

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  - Ports: 1 Serial, 1 Parallel, 1 Game
  - 8 Expansion Slots: 6) 16-bit, 2) 8-bit
  - Enhanced 101 Key Keyboard
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  - 200W Power Supply
  - 5 Device Bays: 3 Exposed, 2 Internal
  - 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
  - Ports: 1 Serial, 1 Parallel, 1 Game
  - Dual Floppy/Dual H.D. Controller
  - 8 Expansion Slots: 6) 16-bit, 2) 8-bit
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  - Upgrade to 1MB
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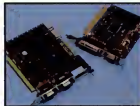


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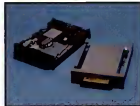


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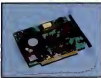
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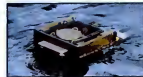


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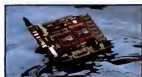
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# Advisor

## PRtSC IN POSTSCRIPT

Is there any software that would let me print my screen to a PostScript laser printer using the PrtSc key? Of course, the output would have to include the IBM graphics character set, without the spaces between the lines.

Brad Choate  
Winona, Mississippi

**PC** It seems as if there's a neat little utility for everything these days. The one that happens to solve your PrtSc dilemma is a public-domain program available on PC MagNet called DISPPS.ARC. DISPPS will accurately reproduce the line-drawing characters, although foreign and technical characters will be jagged but still readable.

Wonder why the line-drawing characters should be a problem at all? The original PostScript printer, the Apple LaserWriter, had no need for a character set that included both alphanumeric and line-drawing characters. This is because the Macintosh's inherently graphical interface—written in a bitmapping language called QuickDraw—enabled it to combine graphics and text and translate them easily into vector-based PostScript.

Character-based IBM PCs, on the other hand, had to find a way to combine text and graphics in one character set; hence, the high-end ASCII characters. DISPPS translates these characters into bitmaps and sends them to the PostScript printer.

If you have a lot of text-only screens, or if you want an easier way to control your printer, a more elegant solution might be *Trading Post*, a \$79 PostScript printer utility from LaserTools Corp. (3205 Buena Vista Way, Berkeley, CA 94708; (800) 346-1353, (415) 843-2234). *Trading Post* will allow you to perform screen dumps to your PostScript printer and to print from applications that don't support PostScript; unfortunately, it won't satisfy your IBM graphics emulation needs.

*Trading Post* lets you set up virtual

■ **PRtSC IN POSTSCRIPT:**  
Using the PrtSc key with a PostScript printer.

■ **HARD DRIVES FOR YOUR IBM PS/2 MODEL 50:**  
Upgrading your storage without losing a slot.

■ **EVICTING YOUR TSRs:**  
Keeping your memory under control.

printer ports with particular characteristics; in your case, for example, you would define a text printer port to which you would direct all of your screen dumps. The utility then would translate your output to the PostScript text font and send it through the true printer port to the printer. Unfortunately, you don't get IBM graphics emulation because you're dealing with a PostScript text font that doesn't include those characters.

For more information about *Trading Post*, see First Looks in the January 31, 1989, issue of *PC Magazine*.

## HARD DRIVES FOR YOUR IBM PS/2 MODEL

When I bought my PS/2 Model 50 nearly 3 years ago, I was sure that I could make do with a slow 20MB hard drive, but now my bubble has burst. I'd like to add a second drive of at least 60MB to my overloaded system. If a second drive isn't possible, can I get a big, fast drive?

Foster Coburn  
Lawrence, Kansas

**PC** In the years since the PS/2 Model 50 was introduced, many readers have written to us with this question; unfortunately, third-party hard disk suppliers have not exactly been racing to

fill the need, and IBM offers only a 60MB replacement drive for over \$1,000.

You've probably seen ads for PS/2-compatible drives and wondered why they're not compatible with your PS/2. One problem is that there's no standard PS/2 drive architecture; for instance, the Model 70 and the non-MCA Model 30 286 have embedded controllers, while the Models 60 and 80 have a more traditional cable-to-controller design. The PS/2 Model 50's major architectural eccentricity is that the edge connector on the drive plugs directly into the controller, which occupies a dedicated slot on the motherboard (not one of the Micro Channel expansion slots). Instead of residing in a bay on the front of the machine, the hard drive sits behind the bays. ("IBM's Bold New Move," which appeared in the July 21, 1987, issue of *PC Magazine*, shows an exploded view of the Model 50.)

To use a "regular" MCA-compatible drive, rather than one geared specifically to the Model 50, you'd need to replace the controller; that would mean giving up one of your three expansion slots.

But there's good news: someone *does* have a drive for you. Core International (7171 N. Federal Hwy., Boca Raton, FL 33487; (407) 997-6055) sells 44MB (\$585) and 80MB (\$1,695) drives that can either replace or supplement your existing configuration without taking up a slot for a new controller. The 44MB has a rated average access time of 24 milliseconds and a track-to-track access time of 5 ms.; the times for the 80MB drive are 15 and 4 ms., respectively. Both drives have Mean Time Between Failure ratings of 50,000 hours and come with 3-year warranties.

Since the Model 50's controller has only one connector, both drives include a cable that splits the controller signal for use with two drives. The cable snakes above the T-shaped connector card for the floppy disk drive; the card sits behind the two drive bays, connecting the second hard disk in bay B (if you have one).

## Advisor

### EVICTING YOUR TSRs

I have some questions about programs that are gobbling up my precious RAM—specifically, TSRs and good old DOS.

First, is there away to find out which TSRs are resident at any given time? Is there a way to get rid of some or all of them if I them hogging too much memory?

Also, what about DOS? Do the different versions use different amounts of RAM? How much memory should I expect the versions of DOS later than 3.0 to use?

Flex McCoy  
Brooklyn, New York

**PC** Starting with your last question—which is the simplest to answer—DOS 3.x uses about 16K of RAM, a relatively trivial amount once you start shoehorning your device drivers and TSRs into memory as well.

As for your first set of queries, there are several products that can help you manage your TSRs. You can get TurboPower Software's *TSR Utilities* free on PC MagNet

(connect charges only) or on-disk from the company for a \$10 time-and-hassle fee. (Contact the company at 3109 Scotts Valley Dr., #122, Scotts Valley, CA 95066; (408) 438-8608. The filename on PC MagNet is TSR.COM25.ARC.)

The *TSR Utilities* consist of eight separate programs. You run MARK, or its smaller compatriot FMARK, to place a pointer in memory before loading a TSR. To remove that TSR, you then run RELEASE. You can have more than one marker in memory at any given time, enabling you to peel away layers of TSRs. If you've forgotten what's resident, MAPMEM gives you a list of loaded programs, their hooked vectors, and the amount of RAM they occupy. To avoid memory clashes, you can temporarily DISABLE any TSR without removing it from memory. RAMFREE lets you check how much free RAM you have without running DOS's CHKDSK.

TurboPower's utilities aren't very glamorous, and the documentation can be daunting on occasion; for instance, an explanation of one command-line parameter reads "Revector the 8259 interrupt controller(s) to powerup state." If you'd

prefer something slicker, you can choose Persoft's *Referee* (\$69.95; 465 Science Dr., Madison, WI 53711; (608) 273-6000) or Bloc Publishing's *PopDrop* (\$49.95; 800 SW 37th Ave., #765, Coral Gables, FL 33134; (305) 445-0903).

Another option you might want to consider is a context switcher. Instead of loading and unloading your TSRs, programs such as Helix Software's *Headroom* (\$95; 83-65 Daniels St., Briarwood, NY 11435; (718) 262-8787; see First Looks, February 28, 1989, for a review) and SoftLogic Solutions' *Software Carousel* (\$79.95; 1 Perimeter Rd., Manchester, NH 03101; (800) 272-9900, (603) 627-9900) swap entire applications from conventional memory to expanded, extended, or disk-based memory and back, saving your place in each and providing near-instantaneous transitions among them.

### ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see the "By Modern" sidebar in the Utilities column for access information). Please specify your equipment. ■

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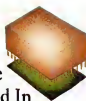


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PC Magazine (4-11-89)

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- One parallel and two serial ports
- Enhanced 101-keyboard and INTERGRATOR™ software
- 20.4 rating on Norton's SI 4.0 test

286/20	Monitor & Video Card	
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117MB	\$2,575	\$3,045
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- Norton's SI 4.0 test rating 23.0 (386/20) and 28.8 (386/25)

386/20	Monitor & Video Card	
Hard Drives	MGA	VGA
40MB	\$2,735	\$3,225
80MB	\$2,945	\$3,415
117MB	\$3,175	\$3,645
320MB	\$4,095	\$4,565
386/25		
40MB	\$3,455	\$3,925
80MB	\$3,645	\$4,115
117MB	\$3,875	\$4,345
320MB	\$4,795	\$5,265

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# CompuAdd

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Corporate volume buyers gave CompuAdd the highest scores in value for the price, compared to systems from Compaq, Zenith, NEC, Hewlett-Packard, Acer and Dell.

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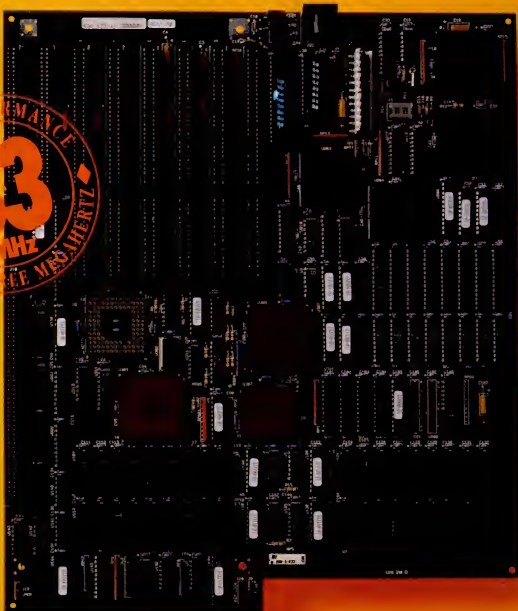
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# First Looks

Hands-on Reviews of the Latest Products

## Integrated Graphics, Multiple Views, and Improved Data-Analysis Tools Revivify Reflex

HANDS ON  
by Richard Hale Shaw

It's not every flat-file database manager that offers sophisticated data-analysis tools and lets you display multiple views and graphs on-screen at the same time. But those are the features Borland International hopes will make using *Reflex*, Version 2.0, its \$249.95 flat-file manager, an involuntary action.

*Reflex* lets you create, display, and switch between multiple views of a database. With a few mouse clicks, you can split the screen into windows and create a "form" view (which displays the current record) and a "list" view (which horizontally displays several records) in each window. When you move to a different record or change a record's data, the other window is updated immediately.

You can also create Graph, Crosstab, and Mail Merge views and display all five views simultaneously. Mail Merge view lets you create and modify form letters and preview them on-screen. With *Reflex*'s Crosstab view, you can analyze data across the fields in each record. Graph view lets you choose from five graph types, including line, stacked bar and pie chart, for graphing database data. You can print the graphs or save them to .PCX or PostScript files.

Regardless of your expertise, *Reflex*'s Microsoft Windows-like interface—complete

CONTINUES ON PAGE 35



By selecting commands from *Reflex*'s menus, you can create, display, and edit multiple views of a database.

PC  
MAGAZINE

AUGUST 1989  
REVIEW INDEX

### CASE:PM WINPRO/PM

Help automate PM programming ..... 36

### dbPUBLISHER

A report formatter for often-revised data ..... 38

**HOTSHOT PRESENTS**  
A text outline for presentation graphics .... 43

### HJIAAK

A translation utility for graphics file formats... 51

## Deskpro 386/33: Breakneck Speed with Room for Expansion

HANDS ON  
by Mitt Jones

If you've been admiring the styling of Compaq's newest small-footprint PCs but don't want the "small" that comes with them, take heart: the Compaq Deskpro 386/33 not only ranks as one of the fastest PCs ever to find its way into PC Labs, but the machine is also among the more expandable and better-looking.

This latest desktop machine follows the same stylish design as the Deskpro 286c, 386/20c,

and 386S—complete with rounded edges and colorful trim. Unlike its slower brethren, however, the \$10,499 machine measures a healthy 19.25 inches wide, generous enough to accommodate six 16-bit and one 8-bit slot. Add space for up to five internal drives and you've got a system that should prove difficult to outgrow.

As with the 386/20 and 386/25, this latest speed leader makes use of a static-RAM memory cache and Compaq's Flex Architecture, which runs a proprietary 32-bit memory bus

at full clock speed while running the I/O bus at an industry-compatible 8 MHz. The 386/33 boasts a few modest improvements, however.

For starters, Compaq doubled the size of the static-RAM cache, from 32K to 64K. The 386/33 also makes use of faster SRAM—25 nanoseconds—in order to keep up with the higher clock speed.

Least you worry that *Lotus 1-2-3 3.0* may use more memory than early reports claim, the proprietary 32-bit memory card

CONTINUES ON PAGE 34

## First Looks

### Compaq Deskpro

CONTINUED FROM PAGE 33

now makes room for a full 16MB of memory, up from 12 for the 386/25. The system's standard 2MB of interleaved 80-ns. RAM comes soldered to the card. Seven sets of pins let you expand RAM to the 16MB maximum using Compaq's \$1,299 2MB daughtercards.

In another new twist, at least for Compaq's top of the line, both the VGA and hard disk controllers are integrated into the motherboard. Both can be bypassed or disabled in favor of other options.

The disk controller runs the standard-equipment Conner Peripherals 84MB hard disk at a 1:1 interleave. The subsystem turned in impressive results on PC Labs benchmark tests, both in the disk's average random access time—24 milliseconds—and file throughput.

The 386/33 will surely shine for two of its intended applications: CAD workstations and LAN servers.

For CAD, Compaq offers its relatively new Advanced Graphics System, a TI-based controller and 16-inch monitor capable of 1,024- by 768-pixel resolution and 16 simultaneous colors out of a palette of 16.7 million. With an optional daughtercard, the subsystem can handle 256 simultaneous colors. A curious pass-through adapter, which comes standard with the 386/33, installs at the right end of the system's I/O bus and connects to the Advanced Graphics Adapter via a ribbon cable. The pass-through card allows both the VGA and Advanced Graphics adapter to drive the same monitor, ensuring full graphics compatibility.

The machine permits both a 33-MHz Intel 80387 and a Weitek 3167 math coprocessor to be present at the same time. Both sockets lie in clear view toward the front of the system board.

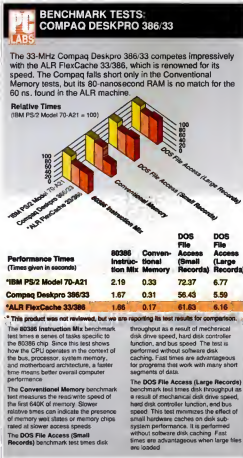
For LAN server applications, the 386/33 offers hard disk capacity and speed the



The Compaq Deskpro 386/33 can function equally well as a CAD workstation or LAN server.

competition will be hard-pressed to match. The \$14,999 Model 320 comes with a 15-MHz ESDI controller and half-height 320MB hard disk drive; the \$17,999 Model 650 features a full-height 650MB hard disk drive with the same controller. Both drives are rated at 18 ms.

The system allows installation of either four half-height drives or two full-height drives in addition to the standard floppy disk drive, resulting in an internal hard disk capacity of 1.3 gigabytes. You



## FACT FILE

**Compaq Deskpro 386/33**  
Compaq Computer Corp.,  
20444 FM 149, Houston, TX  
77070; (713) 370-0670.  
**List Price:** Compaq Deskpro  
386/33 Model 84, with 2MB  
RAM, 1.2MB floppy disk drive,  
84MB hard disk, \$10,499;  
Model 320, with 320MB ESDI  
hard disk, \$14,999; Model 650,  
with 650MB ESDI hard disk,  
\$17,999; 2MB Memory Module,  
\$1,299; additional floppy disk  
drives, \$275; 40MB tape drive,  
\$799; 150-250MB tape drive,  
\$1,999; 2-AUX-bay-per-second  
internal modem, \$599; VGA  
monitor, \$699; Advanced  
Graphics Color Monitor,  
\$1,999; Advanced Graphics  
1024 Controller, \$1,499;  
Advanced Graphics Memory  
Board (512K RAM), \$599; MS-  
DOS 3.31, \$120; MS-DOS  
4.01, \$150; MS-DOS 2 Standard  
Version 1.1, \$340; Intel 80387  
coprocessor, \$1,599; Weitek  
3167 Coprocessor, \$2,199;  
Fixed Disk Expansion Unit  
Model 300, includes one  
300MB drive, \$6,399;  
additional 300MB drive for  
expansion unit, \$5,999; Fixed  
Disk Expansion Unit Model  
650, includes one 650MB drive,  
\$9,399; additional 650MB drive  
for expansion unit, \$8,999.  
**In Short:** A top-quality field-  
leading 33-MHz desktop 386  
that leaves ample room for  
expansion.

CIRCLE 466 ON READER SERVICE CARD

can also install as many as two Compaq external drive units for a maximum system storage capacity of 2.6 gigabytes.

For the security-conscious among us, Compaq built in both a BIOS-based password-protection system, which is disabled as the default, and a system cover lock, which rests on the back panel. The lock does not disable the system or keyboard, but that shouldn't be a problem as long as you don't mind using the password system.

My only real complaint with the 386/33 has to do with Compaq's new chassis design. In order to stack three drives into the front-panel bays, Compaq supplies floppy disk drives that are about 3/4 inch thinner than standard half-height drives. Of course, Compaq will sell you all the spares your heart desires, but it's rather annoying to have



## First Looks

to worry about proprietary floppy disk drives.

All in all, the Deskpro 386/33 rates as a fine high-end machine. The machine is a bit over-powered and over-priced for the average desktop, but the average desktop isn't its intended home. If your applications cry out for power or if you simply want one of the best PCs money can buy, the Compaq Deskpro 386/33 certainly won't disappoint you. ■

## Reflex

CONTINUED FROM PAGE 33

with pull-down menus and dialog boxes—makes the program easy to use. Want to open a database? Use the mouse to click on the Database pull-down menu and select Open. A *Reflex* dialog box will prompt you for the filename. Don't know the database name? Just select one from a pop-up list box. Want to change the size of a window or a column's displayed width? Click on the border with the mouse and resize it to your heart's content. If you want to omit a field from a view, just select and delete it (it's untouched in the database). You can enlarge a view to full-screen or shrink it back to window size, and you can save an arrangement of views to recall when you wish. When you reopen a file, *Reflex* will redisplay the last set of views that are associated with it.

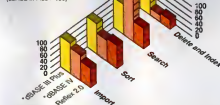
The program also lets you define fields as formulas based on other fields. For example, you might define "average-price" as "sales/quantity". If a field length is too small, select Field Properties from the Database menu and enter the new field length. While *Reflex* will create a data entry form from the database structure, you can change the field labels and screen positions with a few key-strokes or mouse clicks. And it's effortless to cut and paste field names and data from one position to another or from one view to another.

*Reflex* lets you filter your databases, so you can find individ-

## BENCHMARK TESTS: REFLEX 2.0

Using a 5,000-record test file, *Reflex* 2.0 clearly outperforms *dBASE III Plus* but fares better than the newer *dBASE IV* only on the Import and Search tests. Using extended memory improves *Reflex*'s times; the most dramatic is a 25 percent speedup on the Delete and Index test.

Relative Times  
(dBASE III Plus = 100)



Performance Times  
(Times given in seconds)

	Import	Sort	Search	Delete and Index
*dBASE III Plus	352.00	134.00	8.00	165.00
*dBASE IV	258.00	92.00	13.00	38.00
Reflex 2.0	229.78	101.94	5.39	50.63

This product was not reviewed, but we are reporting its test results for comparison.

The *Import* test measures how quickly the database can import an ASCII file (of either fixed field length or comma-delimited format) with an index on the first field. We include the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs require a two-step process for this test: an import followed by indexing.

The *Sort* test measures the time it takes for the package to sort the files on an

unindexed field in ascending order.

The *Search* test measures the time it takes to locate the first record that satisfies two criteria (make = Fenders and model = coupe).

The *Delete and Index* (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this test, and then to reindex the file if necessary.

ual records and screen out those that don't meet the filter criteria. You can save filters and re-apply them to a database at will. The *Reflex* Report Writer and Label Designer let you customize your own reports and labels. In minutes, you can combine the Report Writer and *Reflex*'s filters and sorting facilities and knock out a report that would take hours to create with other flat-file managers. The preview feature will let you display reports and labels on-screen before you print them.

*Reflex* includes 79 functions that closely resemble those found in *Lotus 1-2-3* and provide math, financial, and text-manipulation capabilities. You can use them in any part of the program, particularly in graphs, cross-tabs, and conditional operations.

Other features in *Reflex* 2.0

include bigger files (up to 32MB or 65,000 records) and memo fields (up to 8K—*Reflex*'s variable-length records prevent them from consuming disk space unnecessarily). *Reflex* periodically saves your data, easing worries about power outages. The program includes full color support (including EGA and VGA), and it allows you to select a smaller screen font if you're willing to trade off higher resolution to see more data at a time. *Reflex* can also take advantage of expanded or extended memory. A full-screen text editor with block moves and search-and-replace is also available.

If you want to import or export data from other types of data files, *Reflex* provides a file translator that can read and write 12 file formats. You can use it to import and export 1-2-3

and *dBASE* files, files from five word processors, and import data from *Q&A*, *RapidFile*, and *PFS:File*. You can customize your own translation specifications for unique file formats and save them for reuse.

Although *Reflex* excels at what it does, there is room for improvement. I love using the mouse with *Reflex*, but the mouse interface is neither consistent nor broad enough. Mouse users will find too many places, such as on-line help, where the mouse is useless half the time. The program also lacks the macro facilities found in *Q&A*. When I mentioned this to Borland, a company representative suggested that I use Borland's *SuperKey* program. What I had in mind was additional functionality, not an additional purchase. Finally, there are times when the program is busy but gives you no indication that this is so.

In spite of these minor shortcomings, *Reflex* has a lot going for it. The integrated database, data analysis, and graphics facilities, wrapped in a graphical user interface, make for a powerful combination. The program is not designed to handle large, shared databases—you should look to Borland's *Paradox* for that—but it does offer more functionality than you'll find in most flat-file managers. Best of all, you'll find yourself productive with it in no time. ■



## FACT FILE

**Reflex, Version 2.0**  
Borland International, 1800 Green Hills Rd., P.O. Box 680001, Scotts Valley, CA 95066-0001; (408) 438-5300  
List Price: \$249.95 (\$75 for upgrade).

**Requires:** 512K RAM (640K RAM recommended), hard disk, graphics card, DOS 2.0 or later.

**In Short:** A flexible flat-file DBMS with integrated cross-tabs, presentation graphics, multiple views, and an interface you'll love. Easy-to-use and easy-to-learn, this program can import and export most major file formats and produce reports and labels in a snap.

CIRCLE 488 ON READER SERVICE CARD

## First Looks

# Two Development Tools Assist PM Programmers

HANDS ON  
by Charles Petzold

When encountering the OS/2 Presentation Manager for the first time, most programmers have just one word to say: "Help!"

Two new program development packages—Caseworks' *CASE:PM* and Xian Corp.'s *WinPro/PM*—provide this help. These are PM programs that assist you in writing your own PM programs by generating much of the overhead code typically required.

*CASE:PM* is similar to *CASE-W*, Caseworks' development environment for *Microsoft Windows*. The \$995 package lets you interactively design your program's menu and specify other characteristics of your program, such as the titlebar text, client window size and position, and compiler options. From *CASE:PM*'s menu you can also invoke a text editor and several tools of your choice. (The program is initially configured to let you run the standard *ICONEDIT*, *FONTEDIT*, and *DLGBOX* utilities included in the *Microsoft* and *IBM OS/2 1.1 Programmer's Toolkit*s.)

Select the "Generate" menu option and *CASE:PM* will generate source code—a C file, resource script, header file, module-definition file, and Make file. The Make menu option runs *MAKE* on the Make file and creates an executable pro-

gram, and the Run menu option runs it. The resulting program doesn't do much of anything, of course, but it's a functional PM program ready for your application-specific code.

The C source-code file contains window procedures for the client window and your dialog boxes, and it is heavily commented. You can edit it and make your own additions. Even if you go back to *CASE:PM* to make some modifications, your additions will be preserved in subsequent code generations.

Interestingly enough, people without PM (or *Windows*) programming experience seem to find *CASE:PM* more impressive than those of us who have been working with these environments for a while. Most PM programmers build up a collection of small programs and code that they simply copy and patch together to make a new program. This is usually a faster process than creating a program

using *CASE:PM*. It also allows the inclusion of common code fragments that *CASE:PM* does not generate (such as Scrollbar logic, logic to check and uncheck mutually exclusive menu items, the display of a message box to ask for user confirmation before the program terminates, code to obtain system font metrics, and so forth).

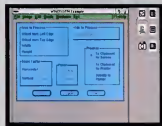
Moreover, it is difficult to work with both *CASE:PM* and *DLGBOX*, the interactive dialog box editor included with the *IBM* and *Microsoft OS/2 Programmer's Toolkit*s. Any header file created in *DLGBOX* is either ignored or—if it has the same name as the application—destroyed when *CASE:PM* generates its own code and header file. The ideal interactive development tool would combine the functionality of *CASE:PM* and *DLGBOX* in one program.

Like *CASE:PM*, Xian's *WinPro/PM* is a code generator that began life as a *Windows* tool (called *WinPro2*), but it takes a very different approach. The \$350 program is not nearly as interactive as *CASE:PM*, and you need a bit more background in PM programming techniques to get started, but it offers the

other files (C source code, header file, etc.) necessary to create an executable program.

An editable file called *SKELETON.PM* contains all the boilerplate code, so you can make your own customizations—with some care. For example, if there's something you often do in a window procedure when a window is first created, you can add the code to *SKELETON.PM* and it will show up in later code generations. However, once you generate a program and make some changes to it, you can't rerun *WinPro/PM* to re-create the program without losing these changes.

Neither *WinPro/PM* nor *CASE:PM* comes close to the visual application building that some of us expect to characterize programming in the 1990s. But both address the more immediate problem of providing needed help for programmers coming to terms with the Presentation Manager. ■



A sample program (and one of its dialog boxes) created by *WinPro/PM*.



### FACT FILE

**CASE:PM, Version 1.0**  
Caseworks Inc., 1 Dunwoody Park, # 130, Atlanta, GA 30338; (404) 399-6236.  
List Price: \$995 (\$795 for limited-time pre-release version).  
Requires: OS/2 1.1, *Microsoft* or *IBM OS/2 1.1 Programmer's Toolkit*, *Microsoft C Compiler 5.1* or *IBM C/2 Compiler 1.1*.  
In Short: A PM development tool that lets you interactively design your program's menu as well as specify such characteristics as titlebar text, client window size and position, and compiler options.

CIRCLE 448 ON READER SERVICE CARD

**WinPro/PM, Version 2.0**  
Xian Corp., 625 N. Monroe St., Ridgewood, NJ 07450; (201) 447-3270.  
List Price: \$350  
Requires: OS/2 1.1, *Microsoft* or *IBM OS/2 1.1 Programmer's Toolkit*, *Microsoft C Compiler 5.1* or *IBM C/2 Compiler 1.1*.  
In Short: A PM development tool that is not as interactive as *CASE:PM*, requiring that you have more of a background in PM programming techniques to get started. Offers the flexibility an experienced programmer will require.

CIRCLE 449 ON READER SERVICE CARD

With *CASE:PM* you interactively design menus in your PM program by specifying information about each menu item using a dialog box.



flexibility an experienced programmer will require.

With *WinPro/PM*, you begin by creating a resource script that contains your program's menu template, dialog box templates, and other resources. By using menu item and dialog box identifiers in a way described by the documentation, you can indicate how dialog boxes are invoked from the menu. *WinPro/PM* reads in the resource script file and generates all the



## First Looks

# dbPublisher Formats, Prints Documents from Database and Spreadsheet Files

HANDS ON  
by Alfred Poor

Few word processors, databases, or desktop publishing programs will let you produce a highly formatted page, with multiple columns, proportional fonts, and several typefaces

gaining experience will have the easiest time learning and using this program.

Over the long haul, though, dbPublisher will save you time. Because it directly reads dBASE files, once you've defined a report format, you can quickly print a new report any time



You command dbPublisher to create a structured program code by selecting fields from a pop-up window.

quickly. But affording you that kind of typographic control over your output is the goal of dbPublisher, a \$695 program from Digital Composition Systems that formats database and spreadsheet information.

Designed for database publishing rather than desktop publishing, dbPublisher is intended to hasten the production of frequently revised documents, such as catalogs, lists, form letters, and directories. But don't expect to be productive within an hour of breaking the shrink-wrap: dbPublisher, even with its Microsoft Windows-like interface, is a demanding program to learn. I spent the better part of a day working through the tutorials and another half-day creating my first report. Pull-down menus and pop-up windows will help as you create your document. Still, people with pro-

you've updated the data in a dBASE table, dbPublisher can work with data from multiple data tables as long as they are related by a common field.

The program can also read

Lotus 1-2-3 files. Since you define the ranges of cells to be used as part of the dbPublisher report definition, you do not have to rely on named ranges within your worksheet. Using the program's File Selection window, you choose the files to be included in a document. Since dbPublisher will automatically convert files of different formats, you can use data from a dBASE file and a 1-2-3 file in the same document.

dbPublisher lets you work all kinds of formatting magic, such as shading every other row of data, or sorting your report on the fly and then grouping the results, and it can perform mathematical and logical calculations. A WYSIWYG preview mode allows you to see your document, complete with page breaks, spacing, and leading, before you print it.

In addition to offering SGML-style mark-up tagging, the program comes with 15 font outlines, which it uses to create any full point size from 4 to 96 points, and supports 31 standard PostScript fonts. It offers a wide range of boxes, frames, rules, border styles, and shading options and can import graphics in .EPS, MAC, .PCX, .PIC, TIFF, HPGL, and .IMG formats. It also comes with a routine that will automatically format a Lotus 1-2-3 .PRN file. dbPublisher even prints bar codes based on information in your data file.

All of this functionality (and more) will use up a lot of system resources. dbPublisher requires



## FACT FILE

### dbPublisher

Digital Composition Systems,  
1715 W. Northern Ave., 2nd  
floor, Phoenix, AZ 85021; (602)  
870-7667.

List Price: \$695

Requires: 640K RAM (570K  
free after DOS and mouse  
driver are loaded); hard disk;  
VGA, EGA, or Hercules  
graphics adapter; PostScript,  
HP LaserJet Plus, HP LaserJet  
Series II, or Epson 9- or 24-pin  
graphics printer; Microsoft-  
compatible mouse; DOS 3.1 or  
later.

In Short: A powerful database  
publishing program that can  
create complex reports using  
data from dBASE tables and  
Lotus 1-2-3 worksheets.  
Requires a significant  
investment in learning time but  
pays off with handsome results.

CIRCLE 448 ON READER SERVICE CARD

10MB of hard disk space and 570K RAM after you load DOS and a mouse driver. You'll also need a fast machine to drive the program. Even running dbPublisher on a 20-MHz 386 machine gave me plenty of opportunities for coffee breaks while I printed documents. Digital Composition Systems recommends an AT as the minimum configuration; you'll want it to be faster than 8 MHz.

dbPublisher is a good solution for people who have to format, revise, and print complex reports based on often-changing information. Its power and results are nothing less than remarkable.

## Publication List

### Software Graphics

#### Graphics Software

Product Review	SlideWrite Plus
Product Review	Picture Perfect
Product Review	GeofTalk
Product Review	Nimble
Product Review	GraphPlan
Product Review	GraphStation
Product Review	Micrograph

#### Best of 1987

Product Review	Show Partner F/X
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### Software Integrated

#### The Business of Words

Product Review	Enable 1.1
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PC Magazine 03/10/87

Advanced Graphics Software  
Computer Support Corporation  
Software Solutions Inc.  
Media Cybernetics Inc.  
Chang Laboratories Inc.  
Yale Graphics  
Willy Verbeke Inc.

PC Magazine 01/12/88  
Brightbill Roberts

PC Magazine 02/25/86  
The Software Group

dbPublisher lets you produce reports, like this sample document, with multiple columns and several fonts and typefaces.

Arma Computers, Inc., 117 Fourier Avenue, Fremont, California 94539 Corporate Office 415-623-1212 Fax 415-623-0816

# If you want better word processing, don't settle for Perfect.

The trouble with WordPerfect® is, sometimes it isn't. Not when you compare it to our new Microsoft® Word version 5.0. Not when you consider that with Word 5.0, you'll pump out your day-to-day jobs quicker, easier, even smarter than you ever thought possible. On your IBM® PC



Introducing new Microsoft Word 5.0. When Perfect just isn't good enough.

or 100% compatible. It doesn't get much simpler than this.

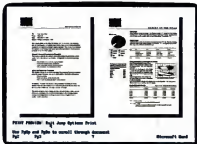
Example: With Word 5.0 you can choose commands by either using simple speed keys or just selecting from a menu.

You can tab, delete, italicize, move, change font and size, even cut and paste with about 50% fewer keystrokes than you-know-who.

Your workgroup can even make any

annotations right on a document, then you can merge and collect all the comments. WordPerfect? No comment.

You can also sort, list, search and archive files across multiple directories,



Word 5.0 Print Preview makes sure what you see is what you want. Before you print it.

All of which is reason enough to try new Word 5.0. But for those who need a little more

## COMMON WORDPROCESSING TASKS

Which requires fewer keystrokes?	Microsoft Word 5.0	Word Perfect 5.0
Copy Block	4	7
Delete Line	2	4
Italicize Word	2	5
Change Font and Size	6	9
Add Footer	1	7
Box Paragraph	5	12
<b>Total</b>	<b>20</b>	<b>44</b>

With new Word 5.0 you'll do about 50% less hunting and pecking than with WordPerfect.

on your PC or across a network, thanks to the Word 5.0 document management and retrieval system.

Or incorporate part, or all of a Lotus® 1-2-3®, Microsoft Excel or Microsoft Works spreadsheet into a Word document. And then update it. In seconds.



## REPORT TO THE FIELD

Sales per region



The following are the most recent sales figures for the Arbor Footwear sales office. All client and distributor inquiries should be directed to these numbers.

Los Angeles	8715
Atlanta	8785
Chicago	158
New York	8817
Miami	8875
Denver	8875

### Shoe enough

Arbor Footwear comes and goings: Jim Dearing becomes V.P. Design for Arbor Footwear and Dees wears. Greg Vrooman moves from People to marketing in Miami. Joan MacArthur and Lisa Don become account supervisor and media planner, respectively.

### Sales per region

Across the board it looks like the South once again led sales in FY '88. With the continuing pump cause those figures should maintain, if not improve. It's important not to let the other areas such as Northeast and Midwest fall.

Style	Shoes	Sport	Casual	Canvas
Evening out	Workout	Tutor made	Dress up	
Midnight moments	Kidswear	Ladies wingtip	Leather	
Twilight motion	Runner up	M.B.A. formal	Special occasion	
Price	\$150-\$195	\$85-\$125	\$120-\$250	\$90-\$130

### Young professionals use Arbor Walker to commute.

Soon, young professional women will no longer be using Arbor shoes simply to climb the corporate ladder. They'll be using them to get there.

This fall we're introducing the Arbor Walker — a shoe that goes quite a few steps further than the now-accepted but unattractive tennis shoes women have been wearing to and from work.

Made of Italian leather with a rubber sole, the Arbor Walker is the perfect combination of style and durability.

Look for promotional materials and carrying cases in early September. Our sales pitch is: "Women don't have to sacrifice looks for comfort."



Arbor Walker designed by Fiori Inc.

### SALES FORECAST FOR 1989

	Types of shoes Summer/Fall/Holiday/Spring			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Dress	95,000	87,000	120,000	60,000
Casual	40,000	82,000	60,000	90,000
Canvas	120,000	85,000	75,000	80,000
Sport	135,000	60,000	90,000	87,000
TOTAL:	390,000	314,000	345,000	317,000

Sample - 5/22/88, 4:52 PM

Let's show forecast for media department expansion.

4th Q - 7/2/88, 1:15 PM

Figure for Northeast and Midwest should be calculated separately mid-month let's catch them before they fall with promo.

Text, graphics, fonts, annotations. Faster, simpler, cleaner. Compliments of new Microsoft Word 5.0.

convincing picture this: Outline View  
When creating longer documents, Outline



Software Digest recently chose the best overall advanced word processor on the market. Who won? In a word, Word.

View lets you switch to a view of headings only. Which means you can see the structure of your entire document, and rearrange it

just by rearranging your headings.

We could go on and on with more

advantages. But your best bet is to call for a convincing demo at: (800) 541-1261, Dept. J62. After you call us, try calling WordPerfect for a demo. Run both, our Word against theirs, head to head, and then ask yourself:

Which one brings your word processing closer to perfection?

**Microsoft®**  
Making it all make sense.





## For People Who Put A Premium On Performance. And Protection.

The more invaluable your data is to you, the more you'll value Verbatim.<sup>®</sup> Because when it comes to high performance and data protection, Verbatim has the winning combination no other floppies can copy.

Consider this: Verbatim DataLife<sup>®</sup> floppies are engineered to perform an average of 50 million revolutions. That's 15 times the industry standard.

Then consider that Verbatim DataLifePlus<sup>™</sup> and DataLife HD 5¼" disks were the first floppies to be factory formatted.

Verbatim also gives you plenty to consider when it comes to data protection. After all, nearly 50% of all computer users have lost time and money due to accidental data loss. That's why Verbatim offers advantages like DataHold<sup>™</sup> and DataHold II

anti-static liners. So static charges are dispersed before they ever have a chance to build up.

For the world's ultimate data protection, DataLifePlus floppies have an exclusive DuPont Teflon<sup>®</sup> coating. So fingerprints and spills can be easily wiped from the recording surface.

And of course, all Verbatim floppy disks are tested to be 100% error free and are backed by a lifetime warranty.

Verbatim data cassettes and cartridges, 8", 5¼" and 3½" diskettes. For people who put a premium on performance and protection.

For more information on the full line of high-quality Verbatim products call 1-800-538-8589.

© Teflon is a DuPont registered trademark.



**Verbatim**  
A Kodak Company

DOING MORE FOR THE DATA PROCESS<sup>™</sup>

CIRCLE 260 ON READER SERVICE CARD



## First Looks

# Hotshot Presents: A Back-to-Basics Approach to Presentation Graphics

HANDS ON  
by Robin Rankin

Many PC presentation graphics programs try to be all things—charting, drawing, and presentation tools—to all people. Not Symsoft's *Hotshot Presents*. The \$349 program takes a back-to-basics approach to presentation graphics, concentrating on the textual structure and organization of a presentation rather than on charting or drawing.

In fact, *Hotshot Presents* doesn't offer charting or drawing tools of its own, which means that you'll have to import graphics and spreadsheet data from other applications once you've organized your show. Instead, the program is optimized for on-screen presentations, offering you such techniques as the ability to reveal individual items in a timed sequence or to highlight a specific item.

Though it's not a *Microsoft Windows* application, *Hotshot Presents* does a fair *Windows* impersonation, using the mouse, a single command line with pull-down menus, and dialog boxes to guide you through creating a show.

Following the example of many Mac presentation programs, including *Aldus's Persuasion* and *Symantec's More II*, *Hotshot Presents* uses a powerful bidirectional outliner to produce the backbone of the presentation. You enter text into the outliner and create a slide template specifying the general attributes of your show. The outlined text is brought into the template, automatically transformed into an attractive word slide.

*Hotshot's* template editor lets you create and apply the global attributes of a show, including border and background information, text size and placement, and bullet design. With

the program's slide editor, you can change a word or insert a new slide; the outline is adjusted accordingly. Slide-editing tools let you modify colors, borders, fonts, and layout information on a slide-by-slide basis. The fonts are built into the program, and while they are not especially plentiful, they'll suffice for most presentations. *Hotshot's* 16-color palette is sufficient but

What the program lacks in dealing with different chart formats and modifying external images, it makes up in handling graphics during presentations. You can incorporate graphics as overlays or underlays superimposed with text, as well as size and lock them into windows. One unusual graphics feature allows you to display on-screen an icon representing graphic or



*Hotshot Presents's* outliner and slide editor make the program useful for creating text-intensive on-screen presentations.

not terribly exciting.

In addition to letting you create bulleted text slides, the slide editor lets you produce table and relatively simplistic organization charts. The fatal omission from the program's well-implemented outline-to-slide approach is that it can't import text or outlines created with other word processing programs.

Although *Hotshot* is strong on producing bulleted charts, it is less facile at handling other chart formats. Similarly, the program can import *Lotus 1-2-3* spreadsheets, but it doesn't let you modify them. As a result, their presentation is functional but not especially stylish. But the program does attempt to map captured images to a default color palette to help ensure that they maintain a consistent look with those created within *Hotshot Presents*.

spreadsheet information that, when clicked on, brings up the associated image. Another noteworthy feature is *Hotshot's* interactive window, which lets you pan and zoom in on images while you're giving your presentation.

*Hotshot Presents* accepts imported graphics in several bitmap file formats (.PCX, .IMG, .TIFF, .MSP, and MacPaint) and two vector formats (.PIC and .CGM). The importation of bitmap files appears to work flawlessly, although the program couldn't recognize some flavors of .CGM. But when import techniques fail, *Hotshot's* screen-capture utility, Grab, should work. (Grab is also the linchpin of Symsoft's *Hotshot Graphics*, a graphics capture and translation utility.)

Once you've crafted the pieces of your presentation, you

string them together using *Hotshot's* show editor, which allows you to specify how long each slide will be displayed and what transitional effects will appear between slides. Tools include 11 built-in special effects and directional sequences. After everything is in place, a Run Show facility displays the prepared show.

Rendering your slides in hard copy is not *Hotshot's* best shot, since the screen displays raster images. The program supports most popular laser and dot matrix printers and the Hewlett-Packard PaintJet. You can print an outline of your show, create speaker's notes (replete with smaller images and annotations), and combine images on a page for audience handouts.

Although the program supports the Polaroid Palette film recorder, it doesn't support high-resolution film-recorder devices, since these require vector output.

Thanks to large-screen monitors, remote-control devices, and LCD panels, the PC is gaining respect as a presentation medium. *Hotshot Presents* adds momentum to this cause by being easy to use and producing impressive results.

**PC**  
FACT FILE

*Hotshot Presents*  
Symsoft, 444 First St., Los  
Altos, CA 94022, (415) 941-  
1552  
List Price: \$349  
Requires: 512K RAM, hard  
disk, graphics monitor, mouse,  
DOS 2.1 or later.  
In Short: The first PC  
presentation program based on  
a text outliner. Allows graphics  
and spreadsheet data to be  
imported from external  
applications. Best suited for on-  
screen productions.

CIRCLE 402 ON READER SERVICE CARD

## First Looks

# Intel Above Board Plus 8: 14 Almost-Cheap Megs Of EMS

HANDS ON  
by Edward Mendelson

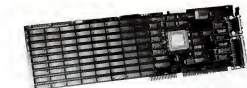
Depending on your point of view, Intel Corp.'s new EMS board, the Above Board Plus 8, is either overpriced or a bargain.

It's a bargain because it lets you use megabit DRAM chips to stuff 8MB of EMS RAM into a single slot. These chips are now the cheapest form of memory you can find, with prices

plummeting below \$125 per megabyte. With an optional piggyback card, you can add 6 more economical MBs, while giving up half of an adjacent slot.

But the list price of the Above Board Plus 8, \$1,495 with 2MB of RAM installed (\$50 less if you don't want the serial and parallel ports), seems to be based on last year's RAM prices of \$500 per megabyte. The piggyback, at \$1,445 with 2MB of RAM installed, is equally high priced, although all these prices are certain to drop before long.

In the PC Labs benchmark tests, the Intel board performed at the top of the scale in EMS memory reads, but because Intel doesn't use alternative hardware register sets in its implementation of the LIM 4.0 standard, the board was among the slowest we've seen at mov-



The Intel Above Board Plus 8 crams 8MB of EMS RAM into one slot. You can add an extra 6MB with an optional piggyback board.

ing data in and out of EMS memory for *DESQview*- or *Microsoft Windows*-style task-switching. To its credit, its one of the few boards that perform flawlessly on the EMS compatibility test.

The Above Board Plus 8 normally uses one of the 16-bit slots of an AT or compatible, but it also works in an XT's 8-bit slot. As is usual with Intel boards, installation is just about effortless. Nevertheless, the Above Board Plus 8 comes with

plenty of detailed help screens and a lucid manual. The board's finish and workmanship is fine enough to be called craftsmanship.

**List Price:** Above Board Plus 8, with 2MB RAM, \$1,495; without serial and parallel port, \$1,445; 6MB piggyback with 2MB RAM, \$1,445. **Requires:** Any 8-bit or 16-bit slot. Intel Corp., PCEO, 5200 NE Elam Young Pkwy., Hillsboro OR 97124; (800) 538-3373, (503) 829-7534.

CIRCLE 436 ON READER SERVICE CARD

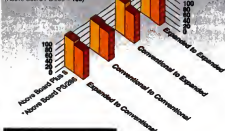


## PERFORMANCE TESTS: INTEL ABOVE BOARD PLUS 8

The Intel Above Board Plus 8 performed a little more sluggishly in our performance tests than did its older sibling, the Above Board PS/285. These results can probably be attributed to the newer board's need to address four times the memory of the old.

### Relative Times

(Above Board PS/285 = 100)



### Move Test 64-byte records

Performance Times (Times given in seconds)	Expanded to Conventional	Conventional to Conventional	Conventional to Expanded	Expanded to Expanded
<b>Above Board Plus 8</b>	6.53	5.60	6.61	6.61
<b>Above Board PS/285</b>	5.89	5.30	5.87	5.04

This product was not reviewed, but we are reporting its test results for comparison.

The LIM 4.0 specification is implemented through a combination of hardware, in the form of an expanded memory adapter board, and software, in the form of the EMM, or Expanded Memory Manager. The EMM is a DOS device driver that controls and manages access to and allocation of expanded memory. It provides a number of services that an expansion card can call upon in order to use expanded memory.

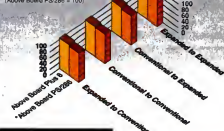
One of the services provided by the EMM is the Move Memory Region function. By requesting that this service

be performed by the EMM, an application can use this function to move a block of data without changing the current memory map. The EMM then takes over and does the actual work of moving the block of data.

The PC Labs Move Test measures how long it takes a board's implementation of the EMM to move a 256K block of data using the Move Memory Region function. The test is performed twice, once using small records and once using large records. The small record test uses 64-byte records and indicates the amount of

### Relative Times

(Above Board PS/285 = 100)



### 128K records

Performance Times (Times given in seconds)	Expanded to Conventional	Conventional to Conventional	Conventional to Expanded	Expanded to Expanded
<b>Above Board Plus 8</b>	4.67	4.61	4.67	4.67
<b>Above Board PS/285</b>	4.45	4.45	4.45	4.45

This product was not reviewed, but we are reporting its test results for comparison.

function call overhead incurred, since the 64-byte move is performed 4,000 times in order to move the entire 256K block.

The large-record test uses 128K records and thus is a measure of the speed at which the EMM can move large multisegment blocks of data. In this case, less overhead is incurred because the 256K block is moved in two pieces.

The data is moved from expanded memory to conventional memory, conventional to conventional, conventional to expanded, and expanded to expanded

memory. For 64-byte records, moves from conventional to conventional should be the fastest because the EMM does not have to save the current mapping context (conventional memory does not need to be mapped as expanded does). Conversely, 64-byte record moves from expanded to expanded should take the longest since the current mapping context must be saved and restored. This difference is less apparent for 128K records, which are moved only twice.

# The Only Keyboard That Guarantees Faster Typing Speed and Greater Productivity...

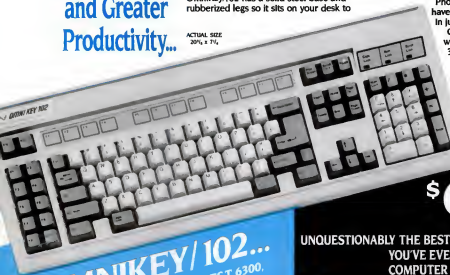
Here's why: OmniKey puts the keys where trained fingers expect to find them. The F Keys are on the left—far easier to hit. Control or Alt the way most people learned and hands down the most logical format.

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—Burton L. Alpersen  
Andrew Seybold's Outlook on  
Professional Computing

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PC Computing

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—Woody Lawson  
Macromin, Nov. 1988

"...the OmniKey/102...is the keyboard I use!"

—John G. Dvorak  
PC Magazine, Dec. 13, 1988

"Although most computers come equipped with some sort of keyboard, you should replace it immediately with Northgate's OmniKey/102. It has the best feel, touch and layout of any keyboard we know, period."

—Sally & Daniel Bretta  
The Robb Report, Feb. 1989

"...12 function keys on the left where God intended them...revolutionary and much needed...Better than any replacement keyboard...duplicates the responsiveness and tactile feedback of the original IBM keyboard...A viable alternative to IBM's own model...durable, well-designed, sensible and has just the right feel."

—Garry Ray  
PC Week

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Ship to (Address) \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone \_\_\_\_\_  
Computer Brand & Type \_\_\_\_\_

QTY	ITEM	SHIPPING	TOTAL
—	OmniKey/102	\$99.00	\$
—	CT 101	\$99.00	\$
—	AT&T 6300	\$124.00	\$
—	PS/2 Models (add for as)	\$25.00	\$
—	PS/2 Models (add for as)	\$25.00	\$
—	<b>*TOTAL OF ORDER</b>		\$

Prepaid amount enclosed \$ \_\_\_\_\_

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## Ventura Publisher Files Managed from the Inside

HANDS ON  
by Edward Mendelson

If you prefer the menu-driven gardens of *Ventura Publisher* to the command-line deserts of DOS, *Desktop Manager* will let you manage your documents in comfort. New Riders Publishing's \$99.95 program is designed to let workgroups keep track of complex publishing projects without leaving the *Ventura* environment.

*Desktop Manager* offers three sets of functions, each available at the press of a hotkey: document control, file management, and timed backup.

Document control lets you review or print a detailed revision history of a *Ventura* document. It also gives you a list of all the document's component files and a list of the formats associated with each tag in its style sheet. Users' initials are automatically attached to the files they work on, because

*Desktop Manager* makes you enter your initials each time you start a *Ventura* session.

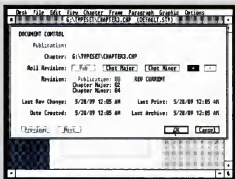
File management lets you move, copy, rename, or delete a document's files while automatically making sure that *Ventura* knows how to find all the files it

needs. Timed backup does exactly that, in intervals of 5, 10, 15, or 30 minutes and beeps a warning 30 seconds before it saves your work to disk. All this takes away only 9K of RAM from the memory available to *Ventura*, and it doesn't mess

around with your *Ventura* configuration files.

Choosing between *Desktop Manager* and its closest competitor, System Network Architects' *VPToolbox Advanced Edition*, a \$149 file and documentation manager for *Ventura*, isn't an easy task. *VPToolbox* has powerful style-sheet-editing functions you won't find in *Desktop Manager*. But *Desktop Manager* offers timed backups and revision-tracking for workgroups, and it can be used from within *Ventura Publisher*. Depending on the functions you need, either program expertly performs tasks that *Ventura* itself ought to know how to do by now.

**List Price:** *Desktop Manager*, \$99.95. **Requires:** 8K RAM, *Ventura Publisher* 1.1 or later, DOS 2.1 or later. **New Riders Publishing**, P.O. Box 4846, Thousand Oaks, CA 91359; (818) 991-5392.



*Desktop Manager* lets you fine-tune the revision history of a document with major and minor revision numbers.

## Personal Measure Diagnoses Performance Bottlenecks

HANDS ON  
by Winn L. Roach

When you start scheduling your coffee breaks to coincide with spreadsheet recalcs or database sorts, it's time to think about upgrading your system for more-reasonable performance. But where do you start? Do you need a whole new system with a faster processor and memory, perhaps even a 386? Or would a fast hard disk be a better buy? Is your printing load heavy enough to justify the cost of a speedy laser printer? How can you know for sure?

*Personal Measure* from Spirit of Performance will tell you. Unlike benchmark-testing programs, this \$69.95 performance-evaluation package does not quantify or grade the performance of a single part of your system. Instead, it monitors the software you run most often to determine which system resources are tapped most frequently and, therefore, in which area a performance improvement would be especially helpful—microprocessor, disk, printer, or serial device.

A TSR (terminate-and-stay-resident program), *Personal Measure* hides in the background, tracking system functions through interrupt use and logging the calling program and time of each interrupt triggered. A separate analysis program tabulates the results and presents an on-screen or on-paper graphical display of resource usage and a chart summarizing the results. The program some-

times annotates possible problems, such as fragmented files. With one look, you can identify the anchor holding back your system's performance.

*Personal Measure*'s documentation is exemplary. While the program is easy enough to use, you'll probably want to read the instruction booklet for its discussion of the program's operation, its evaluation of various benchmark tests (including those used by PC Labs), and its valuable performance-improvement hints.

Incompatibilities proved few. *Personal Measure* and *SideKick* are not the best of friends (a point that is documented), but because this is not the sort of program you'll use every day, such shortcomings can usually be overlooked.

Although recently updated to work with *NetWare* and *Banyan's VINES* as well as *NetBIOS* systems (the version number was not changed), *Per-*

*sonal Measure* still needs a little polish. For example, the few extraneous numbers that occasionally appear in the status display should be banished.

*Personal Measure* can enhance anyone's diagnostics artillery. While its price is modest, many people may still find it somewhat costly for analyzing a single setup. On the other hand, if you need to evaluate the performance of several or even hundreds of systems, you'll find your dollars well spent.

**List Price:** *Personal Measure*, \$69.95 (5½-inch disk); \$74.95 (3½-inch disk). **Requires:** 256K RAM; floppy disk and hard disk; graphics adapter (Hercules, CGA, EGA, or VGA) for on-screen graphical display; HP LaserJet, Epson, or IBM graphics printer for graphics output; DOS 2.0 or later. **Spirit of Performance Inc.**, 73 Westcott Rd., Harvard, MA 01451; (508) 456-3889.

CIRCLE 488 ON READER SERVICE CARD

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important tax data at your fingertips automatically. In seconds, you can print an itemized list supporting your deductions. Plus, Quicken links directly to top selling tax software like TurboTax® and J.K. Lasser's Your Income Tax®.

### NEW VERSION 3.0 FAR MORE THAN A CHECKWRITER

- Quicken is now even easier, faster, and offers 90 new features, including:
  - New credit card, cash, asset, and liability accounts for a complete financial picture.
  - Now combines information from all accounts into consolidated reports
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  - Data import and export
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### The World's #1 Best Seller

Quicken is the best selling business and personal financial software in the world. Bill Howard of PC Magazine (December 27, 1988)



says, "Quicken is about as good as software gets—powerful, affordable and easy to use." Broadway playwright ("Mame") Robert E. Lee remarks, "This astonishingly simple program...is truly true to its name. Indeed, it does quicken the time required for routine bookkeeping."

### No Computerese or Accounting Mumbo Jumbo

Quicken is so easy, you're up and running in minutes. That's because the whole program looks and works just like the paper checkbook and register you've always used. Quicken doesn't change how you do your finances, only how fast you finish them.

### Powerful Business Features

Over half of Quicken's customers use it for small business bookkeeping. Quicken produces financial statements such as Profit and Loss, Balance Sheets and other useful management reports. It forecasts your cash flow, and tracks A/R, A/P, payroll, jobs, clients, properties, and more.

### SPECIFICATIONS

Software Compatibility: Imports from Check-Free and ASCII Exports to ASCII, Lotus® 1-2-3™, Symphony® Quicken® 1.x, 2.x  
Hardware Compatibility: All IBM® PC, XT, AT® PS/2® and compatibles with 128K RAM and DOS 2.0 or higher. Works with your printer and monitor; no payment is. Capacity: Unlimited number of bank accounts and transactions (subject to available disk space). Maximum accounts to \$4,000,000.00.  
Other: Unlimited FREE technical support. Not copy-protected. Checks are pre-generated by all financial institutions in the U.S. and Canada. Sample checks and order forms in Quicken package. Also available for Macintosh and Apple II (license fees vary).  
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G-PC08

## First Looks

### SmartWin: Better File Management For Microsoft Windows

HANDS ON  
by Edward Mendelson

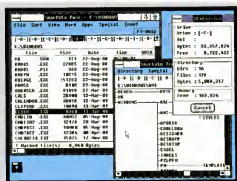
SmartWin has almost all the smarts that Microsoft's Windows' MS-DOS Executive screen should have but doesn't. Romberg & Romberg's \$79 file manager completely replaces Windows' standard menu with a screen that looks almost identical to the MS-DOS Executive, until you notice that it lets you get a lot more done with a lot less work.

SmartWin's main program, SEEXEC.EXE (short for Smart Executive), brings the convenience of DOS file managers like X-Tree into the world of Windows.

You can tell SmartWin to warn you before overwriting files, or you can make it refuse to overwrite a newer version of a file with an older one. It can rename directories, and it lets you view files or change their dates or attributes. It lets you move around your disk by shimmying down a graphic directory tree and then using "accelerator" keys to jump back to the root with a single keystroke.

Unlike the MS-DOS Executive, SmartWin lets you limit the files listed on-screen by date or attributes, and it lets you sort them in all possible ways. It helps you make sense of sprawling directories by automatically marking files whose extensions are listed in WIN.INI. When you've marked a group of files, you can launch an application that will automatically act on one or all of them.

Compared to Wilson WindowWare's CmdPost, SmartWin has vastly richer file-management functions. But where the two programs overlap, CmdPost is the more elegant.



SmartWin displays disk and memory statistics, full directory data, and a graphic tree.

For example, both programs let you add a list of selected applications to their own menu, but only CmdPost can automatically change to the application's subdirectory before running it. If you manage files from DOS, stick with CmdPost. If you want improved file-management ca-

pabilities under Windows, get both.

**List Price:** SmartWin, \$79.

**Requires:** 16K RAM, Microsoft Windows, DOS 2.0 or later. Romberg & Romberg, 6938 Briar Cove, Dallas, TX 75240; (214) 934-2025.

CIRCLE 433 ON READER SERVICE CARD

### PC-SIG Library Offers Thousands of Programs for Less Than 50 Cents Each

HANDS ON  
by Lori Grunin

The PC-SIG Library on CD-ROM perfectly illustrates both the possibilities and the pitfalls of filling a disk with 600-plus MB of data. For \$495, you can have thousands of the PC-Special Interest Group's popular and little-known shareware programs and templates to browse through and play with. That is, if you have the patience for the slow and clunky WordCruncher search interface. PC-SIG's less-than-helpful program listings, and a CD structured for the convenience of the seller rather than the buyer.

The CD contains programs from 1,240 of PC-SIG's floppy disks. Every type of software imaginable is represented—from popular categories such as word processors, databases, and utilities to esoteric programs like font editors and curve-fitting software. Not ev-

ery application may be as sophisticated as its nonshareware counterpart, but there's certainly something for everyone. For \$179, PC-SIG also offers the Personal Software Library CD-ROM, a scaled-down version that contains 365 of the best-selling PC-SIG disks.

Programs are conveniently organized into subdirectories according to the original floppy disk's number. Thus, the indispensable utility CED, which usually comes on PC-SIG disk number 413, can be found in the directory 401\_500/DISK0413 on the CD.

You have three ways to access information about the programs. The menu-driven WordCruncher search program provides the most-sophisticated capabilities, allowing you to perform Boolean searches over the fully indexed file of program descriptions. PC-SIG also includes its own categorical list of the software and a menu-driven

Copy-Access program that switches you into your chosen program's subdirectory. You can also treat the CD as if it were a big hard disk and poke around at will.

Unfortunately, PC-SIG doesn't make life as easy for the user as it could be. You can't bypass the menus of WordCruncher's slow and RAM-hogging interface. Once you have finally located the desired program, there is no way to jump—much less jump quickly—to that program's subdirectory. You have to make a note of the disk number, exit WordCruncher, then use either DOS commands or the Copy-Access program to reach the directory.

Furthermore, once the Copy-Access program has deposited you in a given subdirectory, it terminates; you either have to restart it or type cumbersome path names if you'd like to browse through additional programs.

PC-SIG's listing isn't particularly well-thought-out either. It is composed of disk numbers and titles rather than program names and descriptions. For example, under the DOS utilities category you find "DOS Utilities #3." While this method works for finding the larger shareware offerings, such as PC-Write, the smaller gems require painstaking n inir g.

If the programs were located in meaningfully named subdirectories, the flaws in these search utilities wouldn't be so important. But the CD's structure precludes casual browsing with a simple DIR.

If you like instant software gratification, you'll certainly appreciate having all these programs at your fingertips. But if you don't have the patience to sort out the good software from the bad and the ugly, get the PC-SIG catalog and order the programs as needed instead.

**List Price:** PC-SIG Library on CD-ROM, Sixth Edition, \$495. **Requires:** 256K RAM (384K RAM to use WordCruncher), CD-ROM drive with MS-DOS CD-ROM Extensions, DOS 3.1 or later. PC-SIG, 1030 E. Duane, Suite D, Sunnyvale, CA 94086; (408) 730-9291.

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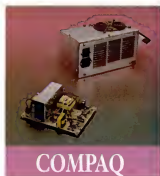
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## First Looks

### HiJaak Converts Graphics Files from One Format To Another

HANDS ON  
by Robin Raskin

Someday target application programs will easily be able to accept graphics in all file formats. Until that day comes, Inset Systems' *HiJaak* will let you translate images from one format to another.

*HiJaak* handles conversions to and from .PCX, TIFF, .MSP, CompuServe .GIF, .CUT, .IMG, and .WPG. This versatile \$149 graphics-translation engine also converts files to and from bitmapped Amiga (IFF) and MacPaint (MAC) files.

But that's not all. *HiJaak* can grab any screen image and convert it to 300-dot-per-inch (PCL) LaserJet format. (If you want to view a captured screen or modify its size and color, you'll have to buy *HiJaak* bundled with *Inset*, a second program that duplicates *HiJaak*'s screen-capture capabilities but adds editing functions.) It can convert HPGL to bitmapped formats and can output (but not accept as a source) Encapsulated PostScript (.EPS) files.

Although *HiJaak* does not support conversions to or from .CGM (Computer Graphics Metafile) or SCODL (Matrix's film-recorder format)—the dominating standards in 35mm graphics—it does handle conversions to and from a number of popular PC fax board file formats. Another useful conversion feature lets you grab ASCII text screens and substitute *HiJaak*'s own object-oriented font, which will give your text a typeset-quality look.

Whether you use its batch mode or simple pop-up menu, *HiJaak* is very easy to operate.

You specify the current format in Column A and the destination format in Column B. The RAM-resident screen-capture program is well-behaved, and the batch mode offers you some handy maneuvers.

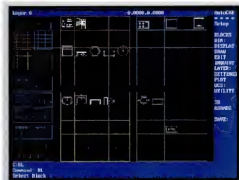
Although it is easy to use, *HiJaak* won't make the conversion process error-free. The success of a conversion can depend on how much the user knows about the file format and how much a particular format varies from a graphics standard. For example, my target applications did not recognize some conversions to .PCX format. According to Inset Systems, its .PCX format includes color palette information that some ap-

plications can't handle. In addition, the colors of the *Harvard Graphics* screens that I captured were altered after *HiJaak* converted them to .PCX and .EPS formats.

But when conversions go smoothly, the program is a minor miracle. If you're tired of using four-letter words to describe three-letter file extensions, *HiJaak* is worth a try. ■

**List Price:** *HiJaak*, Version 1.1B, \$149; \$199 with *Inset*. **Requirements:** 256K RAM; CGA, EGA, VGA, or Hercules graphics board; DOS 2.0 or later. **Inset Systems Inc.**, 71 Commerce Dr., Brookfield, CT 06810; (203) 775-5866.

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To insert a block into a drawing, you select the desired block from *Block Librarian*'s menu screen by using a mouse or digitizer and then drag it into place.

### Block Librarian Retrieves, Stores Blocks for AutoCAD

HANDS ON  
by Jeff Pratise

One of *AutoCAD*'s niceties is its ability to create blocks, or collections of objects grouped together to form a compound object. Once you assign a block name to a group of objects, you can use that name to insert the block into a drawing, thus creating a library of reusable objects and speeding the creation of the design.

But aside from blocks that have already been inserted into the current drawing at least once, *AutoCAD* won't give you a list of block names to choose

from, which makes things difficult if you want to add a block but have forgotten its name. SoftSource's *Block Librarian* will help you out. The \$495 block storage-and-retrieval system for *AutoCAD*, Releases 9 and 10, takes the guesswork out of selecting blocks by letting you interactively choose them from on-screen menus.

*Block Librarian* offers you two ways of selecting a block. You can pick an image from a table with a mouse or digitizer, and then drag it into place. Or you can pick a description of a block from an attributes menu. This method lets you choose a

block not on its appearance but on its attributes, which is *AutoCAD*'s term for free-form textual information that is attached to a block. Selecting a block by its attributes is useful when two or more blocks are so similar that they are hard to distinguish by sight. *Block Librarian* also lets you assign descriptive attributes to a block with an attribute editor, but those attributes must conform to the editor's format if they are to be usable by the program.

*Block Librarian* uses a pair of new commands, BL and BLA, to deliver these enhancements. The BL command brings up a 10 by 10 array of squares representing 100 library pages with space for 100 blocks each (resulting in a maximum of 10,000 blocks per library), and then prompts you to pick a page. After you've chosen the block you want, *Block Librarian* brings you and the block back to the same point in *AutoCAD* you'd have been at had you gone the conventional route, typing INSERT and entering a block name. You use the BLA command to select a block by its attributes.

You can expand *Block Librarian* by adding new blocks, which are defined the same as they are in *AutoCAD* and assigned a menu cell. A utility that comes with the program helps you update the screen menus.

*Block Librarian* can also work with *AutoCAD* block libraries sold by third-party suppliers. Unfortunately, the program itself comes with only a handful of blocks. In light of the relatively high price that SoftSource is asking for the program, the company might have thrown in a few hundred electrical or architectural symbols. Still, if your use of *AutoCAD* is block-intensive, the time *Block Librarian* will save you and the convenience it will add easily justify the cost of the program. ■

**List Price:** *Block Librarian*, Release 10.0, \$495 (U.S. and Canada), \$695 (international). **Requires:** *AutoCAD*, Release 9 or 10, 640K RAM, DOS 2.0 or later. **SoftSource**, 301 W. Holly, Bellingham, WA 98225; (206) 676-0999.

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by  
Alan Cohen

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## Math Coprocessors Provide Alternatives To 80287, 80387

### NEW

Jumping into the tiny numeric coprocessor market that's currently composed of Intel's mainstream products and expensive, powerful coprocessors from Weitek, **Integrated Information Technology** now provides users with 80287 and 80387 coprocessors that offer faster performance than their Intel equivalents, for the same price.

The IIT-2C87 and the IIT-3C87, both CMOS devices, are plug and code compatible with the Intel 80287 and 80387, respectively. Since they require fewer clock cycles to perform the same operations, the IIT-2C87 is almost 200 percent faster, and the IIT-3C87 is 50 percent faster than the competition, according to the company.

In addition, the IIT-2C87 includes extra functions from the 80387 instruction set, such as IEEE COMPARE, IEEE REMAINDER, and a larger range for transcendental functions. It can operate at clock speeds of 10 or 20 MHz; the IIT-3C87 comes in 16-, 20-, and 25-MHz versions.

**List Price:** IIT-2C87, \$299-\$379; IIT-3C87, \$499-\$799 Integrated Information Technology Inc., 2540 Mission College Blvd., Santa Clara, CA 95054; (408) 727-1885.

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**Integrated Information Technology's** numeric coprocessors are plug compatible with Intel's 80287 and 80387 chips.



### HOT PROSPECT

## PORTABLE ETHERNET ADAPTER PLUGS INTO PARALLEL PORT

Xircrom launches the first of its planned connectivity products with the \$695 Pocket Ethernet Adapter. The unit, especially useful for laptop and portable computer users, plugs into any parallel printer port and connects an IBM or compatible computer to an Ethernet or IEEE 802.3 local area network.

The Pocket Ethernet Adapter has a data-transfer rate of 10 megabits per second and includes a Loopback self-test capability. Currently, two models of the unit are available: one for Thin Ethernet applications and another for external MAU applications, including Thick and Twisted Pair Ethernet.

Both adapters weigh just 5 ounces and measure 0.85 by 2.45 by 5.15 inches (HWD).

On-board memory consists of an 8K network buffer (expandable to 32K) and 256-bit EEPROM configuration storage. Drivers for Novell's NetWare, Versions 2.0 and 2.1, are also included.

**List Price:** Pocket Ethernet Adapter, \$695. Xircrom, 22231 Mulholland Hwy., #114, Woodland Hills, CA 91364; (818) 884-8755.

CIRCLE 428 ON READER SERVICE CARD



The Pocket Ethernet Adapter from Xircrom plugs into any parallel printer port, facilitating easy installation and removal.

## Budget Express Adds Spreadsheet Outlining to Lotus 1-2-3

### NEW

For those who use *Lotus 1-2-3* primarily to create budgets, plans, forecasts, or other financial applications, **Symantec's** *The Budget Express* promises to make the job go a whole lot faster. The \$149 *Lotus 1-2-3* add-in, which is being marketed jointly by Symantec and Lotus, supports Releases 2.x of 1-2-3. Incorporating Symantec's spreadsheet-outlining capability, *The Budget Express* allows users to work on any 1-2-3 spreadsheet as if it were an outline.

You can define specific hierarchies of data within a worksheet, collapse and expand columns and rows, and maintain complete control over the depth of detail you wish to view. With a single keystroke, you can collapse a full spreadsheet to show just general subtotals and summaries. To conserve memory, *The Budget Express* saves the

contents of hidden cells to disk; also, the add-in directly supports extended memory.

*The Budget Express* also offers goal tracking, a feature invaluable when it comes to modifying a budget. An on-screen "scoreboard" displays both current and target values, thus allowing the user to view the effect of his changes instantly. Symantec has incorporated commonly used functions, such as totals, percentage change, and running totals, into menu choices.

The package can also consolidate dissimilar spreadsheets by matching rows and columns, labels and locations, or by following the user's own specification. When creating spreadsheets, the *Budget Express* can automatically fill in projected dates as column headers.

**List Price:** *The Budget Express*, \$149.

**Requires:** 64K free RAM, *Lotus 1-2-3*, Release 2.X, DOS 2.0 or later. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; (408) 253-9600, (800) 635-6887 (orders).

CIRCLE 429 ON READER SERVICE CARD

## New & Improved

### American Mitac Offers Micro Channel 386SX-based System

#### NEW

With Intel's 386SX chip rapidly becoming an attractive and cost-effective alternative to both its aging cousin, the 286, and its powerful older brother, the 386, many PC vendors are rushing to bring new SX-based machines to market. American Mitac Corp.'s \$2,995 Mitac MPS2386 offers a new twist; featuring Micro Channel architecture, it is one of the first machines to compete directly with IBM's new PS/2 Model 55.

The Mitac MPS2386, in its standard configuration, comes complete with 1MB of 100-nanosecond RAM (expandable to 8MB); a 1,024 by 768 enhanced Super VGA graphics adapter; six expansion slots; parallel, serial, and mouse ports; one 3½-inch 1.44MB floppy disk drive; and MS-DOS 3.3. The company also offers OS/2.

Also available as options are 3½-inch 40- and 100MB hard disks, retailing for \$650 and \$1,375, respectively (a disk controller lists



American Mitac's 386SX-based MPS2386 computer features Micro Channel architecture.

for an additional \$69). Both disks are installed internally, leaving room for two half-height 5¼-inch storage devices.

**List Price:** Mitac MPS2386, \$2,995. American Mitac Corp., 410 E. Plumeria Dr., San Jose, CA 95134; (800) 648-2287, (408) 432-1506 (in Calif.).

CIRCLE 438 ON READER SERVICE CARD

### FaceCard Facilitates Background File Transfers

#### NEW

What do you do when it absolutely, positively has to be there overnight? The \$699 FaceCard will let you send and receive documents, data, or any other sort of information automatically, without PC power.

Face Technologies' communications board fits into any slot on an IBM PC or compatible machine. The software allows you to schedule data transfers for designated times. An independent power supply enables background transfers, and the 256K on-board RAM stores the data until you are ready to download it to your hard disk. Transmission takes place via a 1,200- or 2,400-bit-per-second Hayes-compatible modem.

Since the data sits in memory, unauthorized users cannot access your hard disk, even if the PC is part of a network. The 8-bit board uses a 6-MHz processor and a continually recharging DC backup battery to protect data from loss or damage during a temporary power failure.

**List Price:** FaceCard, \$699. Face Technologies Inc., 3711 Plaza Dr., #1, Ann Arbor, MI 48108; (313) 662-8008.

CIRCLE 440 ON READER SERVICE CARD

## IMPROVED

**OS/2 Presentation Manager Toolkit**—The \$500 toolkit includes all the software and documentation needed for Presentation Manager application development. It consists of Softset, a collection of graphical tools for PM; four OS/2 Presentation Manager books; hypertext-based QuickHelp documentation; 3MB of sample code; and 2 hours of Microsoft OnLine electronic support. Each is also available individually. Softset retails for \$150 and includes a dialog box editor, font editor, icon editor, and resource compiler. The books, Volumes 1 through 3 of the *MS OS/2 Programmer's Reference Library and Programming the OS/2 Presentation Manager*, by Charles Petzold, range in price from \$19.95 to \$29.95; the sample code and QuickHelp on-line documentation are available as a package to Softset owners for \$150. Registered owners of the earlier OS/2 Programmer's Toolkit can upgrade to the complete Presentation Manager Toolkit for \$200. Microsoft Corp., Redmond, Wash.; (206) 882-9080.

**DesignCAD 3D, Version 2.1**—American Small Business Computers has added more than 50 new commands and a number of speed improvements to its PC-based CAD system, including Boolean operators, automated slide-show production, enhanced zooming and shading, simulation of multiple light sources, improved mouse and hardware support, and the ability to create complex surfaces by use of patching and Webster algorithm blending. *DesignCAD 3D, Version 2.1*, retails for \$399. Current *DesignCAD*



Version 2.1 of *DesignCAD 3D* features new shading and zoom capabilities.

*3D* users may upgrade to the new release for \$35. American Small Business Computers, Pryor, Okla.; (918) 825-4844.

**BRIEF for OS/2**—*BRIEF*, the program editor for UnderWare, is now available for OS/2. The new release, *BRIEF for OS/2*, contains all the features of its DOS counterpart, plus a few new ones. The package allows users to edit a program in the foreground while their compiler runs in the background under *BRIEF*'s control. If a compiling error occurs, *BRIEF* will alert the user and display both the error message and the offending line of code. The new release also features a C-like macro language syntax, in addition to the Lisp-like syntax found in the DOS version. *BRIEF for OS/2* is a character-mode application and has a retail price of \$195. Owners of *BRIEF for DOS* can upgrade for \$145. UnderWare Inc., Boston, Mass.; (800) 343-7308; (617) 267-9743 (in Mass.).

**MapInfo, Version 4.0**—The latest release of MapInfo's desktop mapping package supports Novell's NetWare-based LANs, allowing multiple users to simultaneously access maps and data. Each user can create separate overlays for a common map, while file locking and edit-transaction files protect data integrity. The package also contains a number of new features, including a database of 5-digit ZIP codes, user-defined symbols and icons, an extended character set suitable for foreign-language applications, auto-save, and ten

CONTINUES ON PAGE 56

**INFO  
WORLD**

**REPORT CARD**

**Multuser Relational Databases**

	Advanced Revolution 1.1	Open III Plus 1.1	Open IV 1.0	Informix 4GL 2.10.02	Paradox 2.0	Paradox 3.0	Open for Mac 2.0	Team- up 2.0
Price (one single user)	\$450	\$695	\$795	\$795	\$499	\$725	\$725	\$795
Performance								
Responsivity (tests)	Excellent	Poor	Poor	Very Good	Excellent	Excellent	Excellent	Very Good
Relational data entry (80)	Excellent	Poor	Very Good	Very Good	Excellent	Excellent	Excellent	Good
Relational reporting (75)	Excellent	Satisfactory	Good	Excellent	Excellent	Excellent	Excellent	Very Good
Relational querying (80)	Very Good	Good	Very Good	Excellent	Very Good	Excellent	Very Good	Very Good
Programming language (190)								
Speed tests	Satisfactory	Good	Very Good	Satisfactory	Good	Good	Good	Poor
Standard operations (60)	Good	Poor	Good	Very Good	Good	Very Good	Excellent	Good
Mixed use model (75)	Very Good	Poor	Very Good	Excellent	Good	Satisfactory	Satisfactory	Very Good
Transaction model (75)	Good	Good	Poor	Excellent	Very Good	Excellent	Excellent	Good
Security (175)	Good	Poor	Satisfactory	Very Good	Excellent	Excellent	Excellent	Very Good
Ease of handling (90)	Poor	Satisfactory	Very Good	Satisfactory	Excellent	Excellent	Excellent	Very Good
Base of use (75)	Poor	Unacceptable	Good	Excellent	Excellent	Excellent	Excellent	Very Good
Basic (90)	Very Good	Poor	Good	Excellent	Very Good	Excellent	Good	Excellent
Multuser features (150)	Very Good	Good	Good	Good	Good	Very Good	Very Good	Poor
Over handling (25)	Satisfactory	Good	Good	Poor	Good	Satisfactory	Very Good	Excellent
Support (90)	Very Good	Very Good	Good	Very Good	Good	Excellent	Excellent	Excellent
Technical support (50)	Good	Unacceptable	Good	Very Good	Excellent	Excellent	Excellent	Excellent
<b>Total</b>	<b>6.8</b>	<b>3.8</b>	<b>5.4</b>	<b>6.3</b>	<b>8.1</b>	<b>8.9</b>	<b>8.8</b>	<b>7.8</b>
Final score								

InfoWorld, April 10, 1989

# The bottom line is 8.9

InfoWorld magazine tested and compared multuser databases. With a bottom line score of 8.9, Borland's new Paradox® 3.0 beat the well-knowns and unknowns hands down.

So read what InfoWorld's Report Card says about relational databases—and if you'd like to try Paradox 3.0 first, there's one more thing you can do.

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## New & Improved

### Portable Hard Disk Compatible with Any Computer

#### NEW

A hard disk is a great convenience for any PC user, but for many laptop computer owners it's been a convenience hard to come by. Weltec Digital's Portable Hard Disk (PHD), a \$1,000 battery-powered portable hard disk, claims compatibility with any system, because it connects through the computer's RS-232 serial port.



**The 20MB Weltec Portable Hard Disk  
connects through your computer's  
RS-232 serial port.**

The 20MB PHD uses MFM encoding and has a 14:1 interleave. Average access time is  
CONTINUES ON PAGE 59

#### IMPROVED

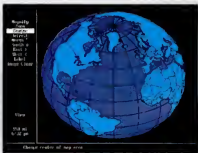
CONTINUED FROM PAGE 54

additional fonts. The package retails for \$750, and a complete array of digitized maps are available separately, ranging in price from \$95 to \$2,000 each. Additional node packs cost \$595 each and a set of these retails for \$1,195. Current MapInfo users who are on support can receive the new version free of charge. The support contract is \$295, with a yearly renewal fee of \$195. MapInfo Corp., Troy, N.Y.: (800) FASTMAP; (518) 274-8673, in N.Y.

**The New Print Shop**—The latest incarnation of Broderbund's *The Print Shop* features greater graphics flexibility, including higher resolution; multiple images per page; the ability to place graphics anywhere on a page; flipping, resizing, and centering capability; and WYSIWYG page preview. Broderbund has also integrated the calendar creator from *The Print Shop Companion* into *The New Print Shop* and added mouse support. *The Print Shop* lists for \$59.95. Current users may upgrade for \$20; if you upgrade within 90 days of original purchase, the upgrade is free. Broderbund Software, San Rafael, Calif.: (415) 492-3200.

**OverDrive 2**—The latest release of OverDrive Systems' document-assembly add-on for WordPerfect features two new options: MergeLink, which imports data directly from dBASE, ASCII, or word processing files; and Data Diary, a built-in data filter. OverDrive 2's other enhancements include pop-in paragraphs and memo fields, and the package allows for a greater number of fields per document. The package ships with OverDrive's *General Business Series* of preformatted templates and forms. OverDrive 2 is available for WordPerfect 4.2 and 5.0, as well as Microsoft Word, and it retails for \$149. Current OverDrive users can upgrade for \$49. A network version is also available for \$349. OverDrive Systems Inc., Cleveland, Ohio: (216) 292-3425.

**Intel Above Board MC32**—Intel's newest addition to its line of memory boards provides up to 8MB of expanded or extended memory for the IBM PS/2 Models 70 and 80. The board is fully compatible with OS/2 and OS/2 Extended Edition and retails for \$595 for the 8K version. A 4MB version, using IBM 80-nanosecond Single In-Line Memory Modules, is available for \$2,895. The Above Board MC32 can be configured to run at zero-wait-states and is fully compatible with all EMS 4.0 software. Intel Corp., PECO, Hillsboro, Ore.: (800) 538-3373.



**MapInfo provides an orthogonal projection of  
the globe for use with your own data.**



# Get the picture.

With Reflex® 2.0, when you look, you see. And you understand what your data really means.

You see trends, cycles, and relationships that are usually missed in ordinary databases, which are nothing more than a numbness of numbers.

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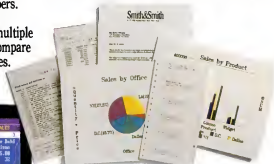
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Most databases give you only one way to enter or look at data. Reflex 2.0 offers many more.

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CIRCLE 377 ON READER SERVICE CARD

# An offer from CDP for PC users who have always wanted to try CD-ROM, but never had the drive.

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1) If you are unable to install a NEC drive purchased from CDP in your computer system within 30 days of receipt, we will issue you a complete refund, including shipping.

2) If, by June 30, 1991, you believe the NEC drive you receive is incompatible with prevailing CD-ROM technology, we will provide you with a new, compatible drive at 50% of the listed retail price of the new drive.

3) All hardware is backed by a full 90-day manufacturer's warranty. If you receive a defective unit, CDP will replace it at any time during the warranty period.



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**CIRCLE 261 ON READER SERVICE CARD**

**DEALERS ONLY CIRCLE 523 ON READER SERVICE CARD**

## New & Improved

### Weltec PHD

CONTINUED FROM PAGE 56

40 milliseconds, with a track-to-track time of 8 ms. The disk has an I/O data-transfer rate of 11K per second and features auto-parking. If you want, you can boot off the PHD.

The unit weighs 7.5 pounds and measures 3.25 by 7.25 by 10.5 inches (HWD). It can run for up to 2 hours at a time on 10 nickel cadmium C cell rechargeable batteries, and the mean-time-between-failure rating is 35,000 hours, according to Weltec.

List Price: Weltec PHD, \$1,100. Weltec Digital Inc., 17981 Sky Park Circle, Building M, Irvine, CA 92714; (800) 333-5155, (714) 250-1959 (in Calif.).

CIRCLE 441 ON READER SERVICE CARD

### VoxMail Lets You Hear Your E-mail Over the Phone

#### NEW

Tired of lugging around a portable or laptop just to check your e-mail messages when away from the office? Well, VoxMail, a LAN-based hardware-software combination from VoxLink Corp., may be just the answer you've been looking for.

Compatible with cc-Mail LAN Package or any electronic-mail package that uses the Novell MHS MTA standard, the \$3,995 VoxMail package converts text-based e-mail into speech to allow direct access to your messages with a standard Touch-tone phone. By dialing into VoxMail and entering a personal ID code, you can retrieve your messages. You respond to them by pressing buttons on the phone that generate specific replies such as "I agree" or "Yes, that date is fine." VoxMail will then send a copy of your response, along with the original message, to the appropriate party.

VoxMail supports five MHS applications, nine reply messages, adjustable security codes, attachment files, additional phone ports, and administrative log reports.

The complete VoxMail system includes a phone interface board, text-to-speech board, program disk, diagnostic disk, and user and administrator manuals.

List Price: VoxMail, \$3,995. Requires: Dedicated IBM PC or compatible computer with network adapter card, two free full-size slots, access to an RJ11-C phone jack, 384K RAM, DOS 3.0 or later. VoxLink Corp., P.O. Box 23306, Nashville, TN 37202; (615) 331-0275.

CIRCLE 442 ON READER SERVICE CARD

# We back up what we don't sell.



**POWERsave™** is the first generic tape backup and restore facility for MS-DOS compatible PC networks. Whether your disks belong to workstations or servers — POWERsave backs them all up.

**Big.** Unattended, it supports up to 16 tape drives of mixed types, including 2.2 GB cassettes, for "an incredible 32,704 GB of data...without changing tapes" using POWERstreamer IV™. And if that's not enough, an operator can feed POWERsave up to 100 tapes in succession.

**Fast.** PC Magazine benchmarks "...the POWERstreamer IV roughly twice as fast as The VAST™ Device (from Emerald Systems™)" on all tests.

**Highly reliable.** PC Magazine "...tried to torment the software, with little success." Replicated directories, tape overwrite protection, dual validation, and other safeguarding features are built in.



POWERsave with POWERstreamer IV

**Easy to use.** Simple menu options allow quick and selective restore by file, directory, or volume.

**Flexible.** POWERsave supports Exabyte 2.2 GB 8mm cassettes, IBM 3480 HI/TC cartridges, and 150 MB tapes, all with SCSI controllers; plus 60, 125, or 150 MB tapes using QIC-36 or QIC-02 standards.

By the way, we do back up and sell one of the networks shown here — POWERlan!



**Call 1-800-825-LANS**

Reseller inquiries invited.

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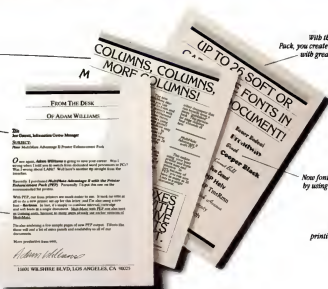


Preview mode lets you check your document before you print.

Includes Bitstream FontWare which lets you create most font sizes you want.

Your finished output matches what you checked on screen in the WPS/RTG Preview mode.

Now you can easily mix and match internal, cartridge, and soft fonts.



With the Printer Enhancement Pack, you create high impact documents with greater ease and versatility.

Now fonts and pitch are selected by using easy pull-down menus.

While your document is printing, you can continue to edit it on screen.

# of MultiMate

With the addition of the MultiMate Advantage II Printer Enhancement Pack (PEP), MultiMate yields a multitude of new advantages.

For starters, PEP makes it easy to take full advantage of nearly 400 different printers. Any of which can be accessed directly from your MultiMate document.

PEP also multiplies the number of fonts you can use and subtracts the hassle of using them. Now you can easily place up to 26 internal, cartridge or soft fonts in a single document!

Pull-down menus are enhanced, too. They now access virtually every MultiMate function. Including printer and font selection. Which sure beats the Helvetica® out of customizing printer action tables.

## And the features keep adding up.

Before you print, the new Preview mode gives you a WYSIWYG look at your page—with actual fonts. Or Preview your coming attraction two pages at a time, side-by-side in reduced size.

Faster file retrieval is yet another new advantage. Just touch a key and a directory tree grows on your screen. Select a directory and all the documents inside are displayed. Then use the lightbar to select any file.

And to add even more to the equation, PEP also gives you free Bitstream screen fonts. Plus the ability to create printer fonts in virtually any size with



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by  
Gus Venditto

# Pipeline

*A Look at the Trends Shaping the Personal Computer Market*

## IBM Unveils Plan for Bridging Platforms, Boosting Productivity

IBM's been hinting at the wonders of its Systems Applications Architecture (SAA) spec for several years now, but it talked about so many pieces in such vague detail that you had to have blind faith to believe that the plan had a higher purpose than to sell IBM's connectivity

products.

Until now, IBM has finally taken the wraps off the big picture, and it's clear that IBM does have a coherent strategy for making computers easier to use at the same time it builds bridges among micros, minis, and mainframes.

OfficeVision is the grand

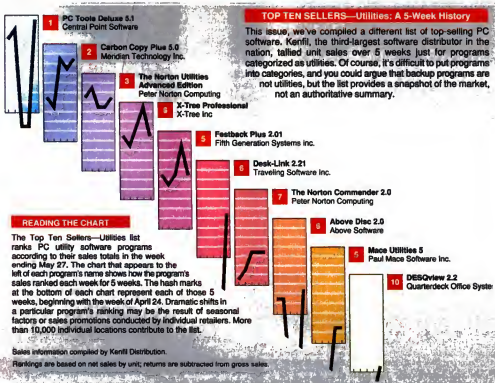
culmination of many SAA connectivity elements, providing a desktop environment that is as simple to use as a Macintosh and as far-reaching as a DEC minicomputer.

OfficeVision uses icons to manage all tasks. It's the same design used in the Presentation Manager and hinted at in *Microsoft Windows*, but here all files will have graphic symbols and the icons will be intelligent. Select a text file and drag it to your address

book; the e-mail system will understand that you want the file to be posted and will attend to the details on its own.

The applications will manage details that current software leaves to the user. And the greatest detail that users can forget is which kind of computer they're using; the interface will be the same on any computer. Icons that appear on a user's display may represent data or programs stored on any System 370, 3090, AS/400, or AT on

CONTINUES ON PAGE 64



# Pipeline

CONTINUED FROM PAGE 63

the network.

If this were just another set of specs for the SAA guidebook, it would hardly be worth writing about. But IBM has quietly been working with some of the top software houses in every hardware arena, making it a good bet that this dream will be realized.

There are two major thrusts: IBM will sell utility applications (e-mail, address book, file manager), and other software publishers will sell applications that plug into the OfficeVision environment.

McCormack & Dodge will have financial and human-resource applications for mainframes; Information Builders will have *Focus* for the DB2 environment; SAS will port its statistical applications; and both Lotus and Microsoft will port their PC spreadsheets.

To help in the conversion



The ultimate face of OS/2: OfficeVision. Icons can represent files that are stored on any IBM computer in the network, whether it be a System 370, 3090, or PS/2.

of 3270 software, IBM will sell *Easel for OS/2*, a programming tool for converting existing 3270 applications to OfficeVision's graphic environment.

Although PC-only networks could benefit from OfficeVision's rich set of tools, it may be some time before the system reaches below large sites with plenty of big iron.

When the first programs ship in September, the cost will be in a mainframe ballpark: about \$7,500 per station.

## Hayes Finally Finds Fax. Can AT Commands Be Far Behind?

Hayes, the modem market leader, seemed to be prepared to nap all through the fax revolution, but the giant has

stirred. It's entered the PC fax market by acquiring one of the top product lines, JT-Fax, from Quadram. To avoid disrupting the JT-Fax board supply pipeline, Hayes and Quadram worked out an elaborate joint-marketing agreement for the rest of the year, but as of early 1990 JT-Fax will be solely a Hayes product.

Now that Hayes has made its first fax move, look for the company to attempt to extend the AT command set with fax instructions. Intel and DCA, of course, have been selling a new software protocol for fax background communications, which Hayes has studiously avoided.

An ISO committee will soon promulgate an official AT command set spec; fax control would be a simple extension.

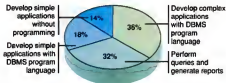
If Hayes is successful in lining up software support, you'll finally be able to manage your fax mail with the same familiar tools you use for other communications. ■



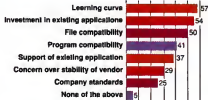
We recently polled 738 callers to PC MagNet about their use of database software. Not surprisingly, 89 percent said databases were used in their office and, of those, 25 percent used *dBASE III*; only 11 percent had stepped up to *dBASE IV*. To try and understand the

reluctance to upgrade, we asked for the reasons why people hesitate to switch. As you might have guessed, investments in learning and applications were leading answers.

## How do you use your database software most often?



## What are the factors that keep you loyal to your current DBMS?



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CIRCLE 112 ON READER SERVICE CARD

# Bill Machrone



**What's a nice  
hardware company  
like IBM  
doing in the software  
business?**

Everyone knows IBM is a hardware company. So what's it doing in the software business? That's what I asked Fernand Sarraz, the general manager of IBM's Desktop Software business unit.

The Desktop Software unit sells IBM-branded applications and languages. Some of them are developed in-house; others are licensed from third-party developers. IBM stands ready to help developers with the positioning, marketing, and rollout of their products. In short, it sounds a lot like a software publishing company.

Sarraz agrees. He is scouring the industry in search of promising software. They don't make a big deal out of it, but they are thorough. One software developer I spoke to said, "Sure, they've been here. They gave what we're doing a very thorough going-over."

IBM Desktop Software hits all the big trade shows, looking for new technology and trying to divine the latest trends. And it hits the panel discussions as well. Back at Spring Comdex, the session that I chaired on personal information managers (PIMs) had a phalanx of Men In Blue Suits in the back of the room.

IBM's interest in PIMs is more than whimsical. The company has announced a "business relationship" with Jensen-Jones, a small firm active in the development of Windows-based products, including personal information management tools. "We believe in PIMs," says Sarraz. "They reflect what people really do."

Sarraz considers Windows extremely important to the Desktop Software unit's success. He points to the burgeoning installed base of Windows-capable machines, the upsurge in Windows-based applications, and a general acceptance of the graphical user interface. "Windows is a commercial opportunity right now," he says, "and it will get better."

## A QUESTION OF RESOURCES

With IBM's Entry Systems Division pushing OS/2 so hard, isn't this attitude a conflict within the ranks? Shouldn't the Desktop Software unit be evangelizing OS/2 applications?

Sarraz sees it differently. He says, "Evangelism is [Entry Systems Division president James] Cannavino's thing. We don't do evangelism,

but we have gone to a lot of Mac events, looking for developers with graphics experience to do things for our platform. We're not looking at graphical applications exclusively, though. We would do a straight DOS application if it made good business sense."

And what makes good business sense? The current revenue stream. Sarraz says, "We could be pursuing OS/2 and AIX vigorously, but it's a question of resources." Aside from that, he remains bullish on OS/2's future: "When people see what can be done with OS/2, the improvements in basic things, they'll want it. Multithreading will have a huge impact on the way applications are designed. Overall, they'll have better applications." And he also warns, "It's rough when you're first, but the people who stay behind will be in trouble."

## CAN THEY PULL IT OFF?

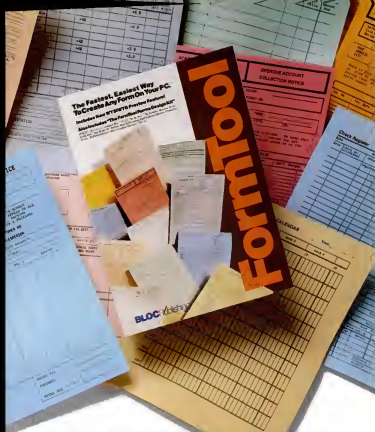
So much for intent. It's clear that IBM's Desktop Software people want their division to be a



ILLUSTRATION: TAPPALE & BOLCONESI

player in software publishing, and they want to make money at it. They even have a cash cow in the barn: *DisplayWrite*.

But it's a big question whether *DisplayWrite*'s success is due to its features and IBM's marketing skill, or whether it's just trading on the installed base of Displaywriters. Does anyone outside the IBM direct distribution umbrella buy *DisplayWrite*? Is marketing prowess an issue here? It's hard to tell. The product does



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## Bill Machrone

sell in the market for standalone PC applications, but well below the volume of *WordPerfect* and *Microsoft Word*.

Jeff Tarter, market researcher and editor of *SoftLetter*, a newsletter that covers software companies, says IBM's Desktop Software business is probably worth between \$60 and \$70 million in sales per year, mainly from *DisplayWrite*. Tarter considers *DisplayWrite* a bundled software sale rather than an independent product. But a war chest is a war chest, and IBM appears willing to make the investment in other software packages.

### OLD WAYS, NEW WAYS

One of the biggest objections I've heard from developers concerns IBM's insistence on exclusivity. IBM wants to be the only distributor for its own branded products. This means that these products never show up on the distribution-driven best-seller lists. And if IBM isn't very effective at promotion, the product might never make it to the dealer's shelves or to the mail-order distributors.

Sarrat's response is that if a developer already has marketing strength, IBM can still work with that firm. "We can look at a menu of marketing opportunities," he says. "We can find ways to get around the exclusivity issue if it's really important."

A more serious obstacle may be royalties. Software Publishing Corp., the author of the *Assistant* series, negotiated a nonexclusive license with IBM back in the old days. But despite IBM's promotional might, including the Little Tramp and all, Software Publishing far outsold IBM through its own advertising and distribution channels.

Software Publishing isn't complaining about its IBM royalty checks, Sarrat points out. But it's unclear whether the company would negotiate the same deal today. Rumor has it that IBM's royalties are less than those offered by other software publishers. That may have to change before IBM gets the products it really wants.

Does the world need IBM as a software publisher? Does IBM bring anything more to the table than a huge sales force primarily committed to selling hardware? Sarrat is determined. And determined people—especially those with the resources of a \$50 billion company behind them—usually get what they want. ■



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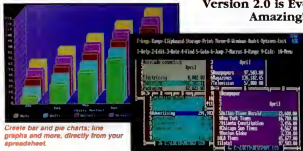
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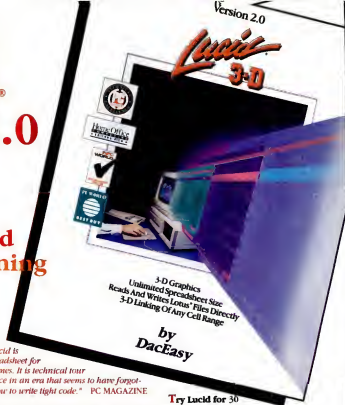


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# John C. Dvorak



**Only when PCs are  
evaluated on the  
basis of what they  
can do, not on some  
theoretically  
achievable  
speed, will there be a  
viable used-computer  
market.**

I was invited to speak before a financial-systems software firm about the future of desktop computing. The CEO was concerned, though, that I might say something like "Windows is dead." This, he felt, would confuse the users to whom he intends to sell a fancy window-based product.

He explained that he was having enough trouble with field offices and their old equipment and their constant demand for DOS-based applications. His observation was simple: the main offices around the country were upgrading to newer equipment, as needed; the field offices in Podunk, Idaho, were staying with the PC-XT.

This observation is not lost on me as I go to a local garage owner and discover a PC-XT-class machine in his office. Discussions concerning upgrading are met with a large smile. Curiously, a year ago users just like him were concerned about the status of their investment in PC technology and worried sick about obsolescence. Enough time has passed for them to become adamant about the PC-XT and its position in the world. Now they all use the bottom-line "we can't throw away our investment" excuse for keeping the beast.

I'm convinced that if there were a viable used-computer market, then many of these old clunkers would be recycled out of the big-business environment and into homes and schools and flower shops where they belong.

During the heyday of the American automobile industry, the American used-car system was the most efficient in the world. We all know how, for example, in the 1950s and early 1960s many people were able to have a new car every year by trading in the previous year's model. The system encouraged the practice, especially among owners of cars like Cadillacs and Lincolns.

Gradually, industry restructuring, imports, interest rates, and other changes in the economy altered the U.S. automobile industry forever, and the used-car scene never adjusted. Few people nowadays have a new car every year, and the classified ads are where you get the best deal for your old car. It's no coincidence that the vitality of the U.S. automakers isn't what it was in 1958, either.

## **NEEDED: A GOOD IDEAL**

There has never been an adequate used-computer arrangement instituted by computer stores. While there are a couple of large vendors of used machines and a few stores that specialize in used computers, this is hardly the solution needed to permanently move the PC-XT out of American businesses.

What is needed is a good deal ("Did I hear someone say *deal*?"). The most adamant XT owners, many of whom are reading this column, would welcome turning in their trusty XT for a speedy 386 machine that can process information at least ten times faster if it could be done with an investment of \$1,000 paid over 3 years.

The key to success is to make sure the machines don't depreciate, but always maintain a fixed resale value based on the prices of new machines and their cost per usable mips. This way a computer becomes a commodity item with a known exchange-rate value and not a



piece of electronic junk. Dealers could recycle the machines in their used-computer lot.

Assigning a value based on cost per usable mips would mean that I/O-choked technologies running around fast processors would be evaluated based on what they can do, not on some theoretically achievable speed. When this happens, then there will be a viable used-computer market, and XTs can be moved smoothly out of American business.

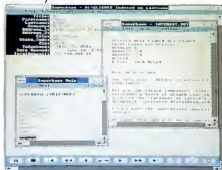
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## Inside Track

I was just booting a 33-MHz 386 machine from VIPC when I got the press announcement from Compaq telling about its 33-MHz machine. Everex, Dell, and everybody who could get a 33-MHz chip had already announced before Compaq. **It no longer means anything to be first, anyway, I thought to myself. Just look at IBM.**

So I shrugged my shoulders and tossed out the press release, which was sent to the wrong address anyway. (How it got to me was a mystery.) I just kept toying with the 33-MHz machine, noticing that even upping the power from 6 mips to 8 mips brings no perceived increase in speed. The classic rule for noticeable performance increase is that **the speed has to double or triple** before it is perceived by the user. 25-MHz 386 users are going to have to wait for the 486—and 15 mips—before they can move on.

Even so, with the I/O-bound display and slow bus speed, I wonder if there will be any perceived speed gain until we go to **full-motion video**. The action right now has to be in improving I/O. That means caching controllers, faster ports, faster video display cards. It's pretty depressing, if you ask me.

**One thing helps.** Most observers agree that with projected new pricing for the 80386 (which reduces the premium people pay for the 25-MHz chip to nil), we can expect a **virtual disappearance of the 16- and 20-MHz 386 machines within a year**. The low end will be some SX machines and fast supercheap 286 machines. The 25-MHz 386 will become the **workhorse** and the 33-MHz will be the premium machine, since it still requires expensive support circuitry. This balance should continue at least **through 1990** as the 486 begins the cycle over again.

Eventually, the 8088-based systems will become the **dead dogs** or smart terminals of the PC world, with diehards adopting systems with 10-MHz speed in a **desperate effort to keep alive** all sorts of old software. Eventually these machines should be swapped out lest the owner be mired in low-end muck. The fact is that the superfast 8088 machines don't save much money anymore.

**CP/M Diehards Never Die, Unfortunately, Dept.:** While on the subject of not saving money, you should note that the members of the CP/M **zombie army** are floating prototypes of 10-MHz Z-280 machines named the **Grudge** machine and the **Vengeance** machine. Some of these "new" 8-bit systems use a baby AT-sized motherboard with **PC-bus-compatible** slots. They use fancy clones of CP/M as the operating system. The people in this weird underground call these computers "DOS killers." **It is to laugh.**

When asked why he chose an 8-bit chip for his Z-88, Clive Sinclair replied, "Because I couldn't find a 4-bit chip I liked."

Watching 8-bit computers fight to stay alive reminds me of a Clive Sinclair story.

When asked by a nosy reporter why in tarnation he chose an 8-bit chip for his Workslate-like Z-88 laptop machine, Sinclair rebuffed the fellow by saying, "Because I couldn't find a 4-bit chip I liked." He was serious. Anyway, these 8-bit machines are fast, **not cheap**, and they veer away from the primary trend in desktop computing, which is Intel- and Motorola-based 32-bit superfast microcomputers. **Dvorak's Rule #26:** Don't be led astray by interesting oddball technologies.

### Genuinely Interesting Hardware

**Dept.:** If you want to quickly load up your machine with a **big disk** on a card, take a look at Silicon Valley Computer's **104MB 23-millisecond Gold-Card**, which sells for \$795. Add \$50 and the disk on a card turns into a floppy controller, too—a nice idea. The company claims it can throw data onto the bus at some 12 million bits a second—without a cache! Just plug it into your AT or 386, move a system to the thing, and you have **upgraded instantly**.

This was one of the few companies not sued by the Hardcard people for copycat technology. SVC has been doing this since the idea jelled. Call SVC at (408) 453-8837.

**Software of the Year Dept.?** If you want to see something worth waiting for, then find a way to grab a copy of the new **Autodesk Animator**. It's an incredible software package that will **forever change the face** of PC-based desktop presentations. No kidding. The things this thing can do I've **never seen done on a PC**. It's my pick for **Software of the Year**, and the year isn't even over. With its 256-color VGA paint tools and an advanced data-compression scheme, animations up to 4,000 frames can be designed and played back at rates of up to 70 frames per second in real time from the hard disk. It's impossible to describe the incredible depth and capabilities of this software, which should be arriving at the stores as you read this. Its only downside is that its layers of intertwined complexity and funky completeness make it potentially the world's greatest time-waster. **Keep unauthorized personnel away.**

**Humor Dept.:** This message from Maria Lilia Martinez showed up in my forum on PC MagNet (CompuServe):

"This month only: Free booklet by E.Z. Street: **How to do weight training with computer books and avoid carrying fitness equipment on your trips**. The author guarantees that with his method, in a month you will be able to free the suitcase space now taken by your running shoes and carry the latest *Q* tome: *Programming dBASE VI: 2,000 Shortcuts*.

I was amused.

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# Jim Seymour



**The interface wars  
may be dangerous.  
If the lawyers  
get their way,  
software developers  
will spend their  
time doing things  
differently,  
not better.**

User interfaces are really hot right now. And no, dear cynic, not just at the meetings of the American Bar Association's Computer Law section.

Anyone doubting it would have become a believer in 10 minutes had they been at the Association for Computing Machinery's CHI '89 conference, which took place in early May. CHI stands for Computer Human Interface, and CHI '89 had virtually all of the biggest and best-known names in the theory and practice of interface design. Attendance soared this year to an all-time high of 1,800 people.

A sparkling four-way debate on the user-interface litigation wars drew reporters from national newspapers and the business press as well as conference attendees. The audience hissed when the moderator finally cut off the protracted question-and-answer session. The formal sessions were vigorous, contentious, and interactive to a degree not often seen in academic or business gatherings in the computer industry. Even the coffee-shop colloquiums were more intense; people crowded 10 and 15 chairs around four-place tables, the better to yell at one another.

But out of all that was said on the speaker's platform and in the hallways, a remark by Michael Leak of Bellcore (the former Bell Labs) stayed with me the longest. He identified better than anyone yet the clear and present danger of today's muddled legal situation.

"We spend a lot of time in computer science arguing about standards and trying to get systems that people can use intuitively and easily," Leak said. "Now the danger is that company managements will tell their people to do everything differently. That will mean every program you buy will look different from every other program. And you'll have a lot of trouble using them."

*Exactly.*

This isn't just a moot-court debating exercise. It's a direct assault on the central thrust of product development today: making things consistent so that they're easier to use.

## **DIFFERENT ISN'T ALWAYS BETTER**

Programs that are hard to use because they look different are nothing new to users of DOS com-

puters, of course. That's the curse of the lack of user-interface tools built into DOS. But with the gradual acceptance of the *Microsoft Windows* and Presentation Manager screen-design and keystroke conventions, we're beginning to see some light at the end of the tunnel.

In fact, as Will Zachmann has pointed out, we may face the blissful prospect of a future in which most small-to-medium-size systems have similar interfaces. On the DOS level, we'll use *Windows*; on OS/2, Presentation Manager; and on Unix, it looks like the *Windows* derivative *OSF/Motif* may be the winner. But only if we don't get caught up in a swirl of everyone doing it differently—not better, just differently, thank you—to avoid being sued.

Copyrights and patents have fostered social and scientific progress and protected the legitimate rights of inventors and their assigns for more than a century. But now those admirable statutes run the risk of being perverted and of being turned toward purposes they were origi-



nally intended to work against.

In part, this problem is due to the changing nature of the intellectual property for which protection is being sought. Software isn't much like books, for which copyright laws were originally written. And computer chips and microcode aren't much like most of the inventions the U.S. Patent Office judges. But equally responsible is the aggressive, predatory attitude of some vendors in the computer industry. Today,

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## Jim Seymour

copyright and patent suits are coming to be seen as legitimate strategic elements in a company's marketing plans.

Does Apple's weird affection for a crude line drawing of a garbage can make much sense? Does anyone think that Apple is really pursuing copyright royalties from Microsoft, Hewlett-Packard, and maybe

**Today, suits are seen  
as strategic elements  
in a company's  
marketing plans.**

IBM in their legal attack on *Windows*, *New Wave*, and, implicitly, *Presentation Manager*? Or aren't Apple's lawyers really just trying to buy time in the courtroom, stalling the competition while Apple's engineers try to catch up in the labs?

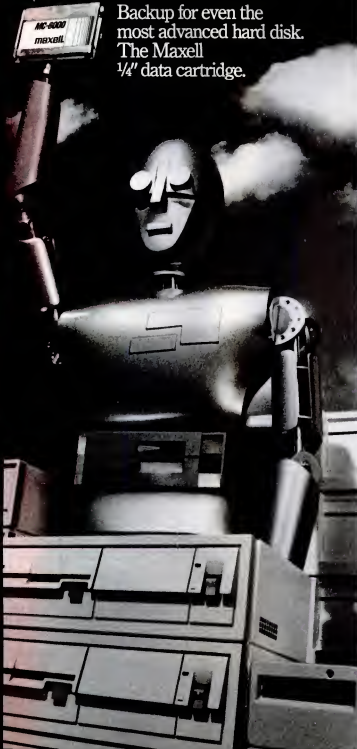
### ON THE SHOULDERS OF GIANTS

As in other creative fields, people working on user interfaces stand on the shoulders of those who have gone before them. Jack Brown, Apple's counsel in its suits against Microsoft and HP, acknowledged the creative aspects of interface design when he said at CHI '89 that much of user-interface design is still an art, not a science.

Tom Hennes, another lawyer in the CHI '89 debate, got to the nub of it when he pointed out that computer software is a "cumulative technology." We build, in software development, on what has been built before. And any force that drives us away from that direction, forcing us to pursue artificially differentiated routes rather than adding good new ideas to the best of the old ones, will have a malign effect.

What scares me most about today's interface litigation is that it may knock us off the track of pursuing programs that are more consistent and easier to use. Partly because the legal tools are inadequate. Partly because judges don't understand computers. But mainly because some companies have shown a willingness to pervert the very laws under which they claim to seek shelter.





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# William F. Zachmann



**There are good reasons why workstations won't take over the PC market. But keep an eye on those workstation vendors!**

There has been a lot of talk recently about workstations as alternatives to personal computers. As workstation vendors have announced products with list prices under \$10,000—comparable to those of high-end 386-based PCs—some analysts have been led to predict that these units will capture a big slice of the business market. Furthermore, some say, business buyers are likely to curtail their purchases while they evaluate these competitively priced workstation alternatives.

With all this horse manure around, it's hard to argue that there isn't a pony in there somewhere. Still, if I may stack up my metaphors a little, there are very good reasons to suspect that this issue is more smoke than fire. For the distinction between personal computers and workstations is not nearly as clear as many commentators would have us believe. In fact, it is a distinction at best dubious, at worst downright misleading. To be sure, these products have historically fallen into two rather different markets. But it is not at all certain that the categories of the past will apply to the markets of the future.

Since the early 1980s the term *workstation* has been applied to single-user systems aimed at specialized fields, such as computer-aided design and artificial intelligence, that are graphics intensive and that require high processor performance and storage capacity. Workstations are typically equipped with more memory, more disk storage space, larger and higher-resolution displays, and faster bus structures than personal computers. As a result they are more expensive, but they can handle applications that personal computers, until recently, just haven't been able to run effectively.

Initially, workstations were built with high-performance proprietary processor architectures, and they cost \$100,000 or more. At that time, standard microprocessors from vendors like Intel and Motorola simply weren't powerful enough to meet the needs of such specialized applications. But as more-powerful 32-bit versions of these chips appeared, they began to show up in the low end of workstation product lines. In particular, the large, unsegmented memory space of Motorola's 680X0 series has ensured for these machines a leading role in the

world of workstation products.

It all adds up to the realization that workstations are simply personal computers for applications that PCs aren't yet powerful enough to handle. Other differences, from processor and bus architectures to operating systems, are incidental. And as the technological overlap between workstations and personal computers grows, the validity of the distinction between them will disappear.

## HISTORY REPEATS ITSELF

Something roughly comparable happened with personal computers and dedicated word processors in the early 1980s. Like today's workstations, dedicated word processors were originally expensive, specialized systems for doing things that personal computers couldn't do. In 1980, IBM's introduction of the Displaywriter (which, remember, was a hardware product built around an Intel 8086 processor) was considered a major breakthrough. It was priced



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very aggressively—below \$10,000!

At the time, there was actually talk of dedicated word processors like the Displaywriter posing a challenge to personal computers. IBM offered CP/M for the Displaywriter, and some analysts thought it might displace the less-powerful personal computers of the time—like the Apple II.

But what actually happened, of course, is that personal computers became capable of do-

## William F. Zachmann

ing word processing as well as or better than dedicated word processors. Personal computers took over word processing, while word processor vendors suffered a decline from which even the survivors, such as Wang, are still trying to recover.

Similarly, today's personal computers,

based upon powerful standard microprocessors like the Motorola 68030 and 68040 and the Intel 80386 and 80486, are capable of taking over tasks once relegated to workstations. The separate workstation market is doomed as surely as the dedicated word processor market was doomed 10 years ago.

Workstations cannot "take over" the personal computer market, because the only way to do so would be, in effect, to

stop being workstations and start being personal computers instead. If the workstation vendors do not suffer the same fate as the word processor vendors, it will only be because they have learned to compete effectively in what is really the personal computer market.

The question, then, shouldn't be posed in terms of workstations versus personal computers at all, for this approach obscures the real issues and trends in the industry. Instead, we should ask whether some of the secondary aspects of today's workstation market are likely to become a significant influence in tomorrow's personal computer market.

Will Unix, the standard operating-system environment for workstations, become a major factor in single-user personal computer use? Will RISC architectures be-

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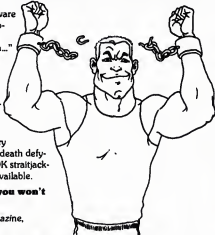
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come viable standard alternatives to the Motorola and Intel architectures that currently dominate personal computers? And will workstation vendors like Sun and Hewlett-Packard/Apollo become major players in personal computer markets?

I have argued previously that, barring some significant surprises, Unix is not likely to be a major factor on desktops in the business world. And in future columns I will argue that it will be a long time before RISC architectures become a major factor there, either. But it's too early to tell whether workstation vendors have a real chance for success in personal computer markets.

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# Stephen Manes



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The salesman smiled tolerantly. "We've never had a single problem of that nature. No, we can actually monitor your alarm at the central office even if somebody has cut your phone wires."

"How's that?"

"The folks across the street have a system just like this one. If your phone line's down, we send your signal across the street to their system, and it reports your alert codes."

"Has this ever actually happened?" I wondered.

"Truthfully? We've just added this capability. But we expect it to become important in the years ahead."

"So we don't really know if it works, do we?"

"We've tested it thoroughly."

"In real-world situations?"

The salesman appeared to be developing a mild case of indigestion.

"What if my neighbor's system starts sending false alarms through mine? Come to think of it, what if mine starts sending false alarms? The city's charging a hundred bucks a call."

"I think you're being a little paranoid."

"If I weren't paranoid, I wouldn't be buying a burglar alarm."

"We guarantee false alarms won't be a problem."

"And you'll put that in writing?"

"Uh, no, but remember: this system is *microprocessor controlled*."

My personal alarm went off.

"Precisely," I said, and sent the fellow packing.

## DOWNLOAD CAPABILITY

Just in time for the arrival of Burglar Alarm Guy Number Two. "Those wireless systems can give you a lot of trouble," he told me confidently. "What you want is the security of our brand-new, state-of-the-art wired system. We've got something no one else can offer."

"What's that?"

"Download capability. It's a first in the industry. We can actually reprogram your alarm from our office."

"Why would I want you to do that?"

"Well, let's say you want to change your access code. Or you fly cross-country and you suddenly realize you forgot to set your alarm



when you left. With this system, we can do it for you over the phone."

First I said, "Great!" Then I said, "Wait a second. Let's say I decide my house sitter is having trouble dealing with the thing and I want you to turn it off. Can you do that too?"

"No problem at all," the salesman said proudly.

"Whoa! Let's say you hire some guy off the street to work at your monitoring facility. He



## Stephen Manes

hooks up with some pal of his. Two nights from Tuesday, he turns off my system. His good buddy backs up to my house with a moving van and cleans me out."

"Well, imagine my boss's delight in employing the world's first victim of burglar alarm hackers. Can I disable this wonderful downloading feature?"

"Can you override that from your office?"

"Oh, sure—I mean, uh, I'll have to get back to you on that." He never did.

### NEARLY SELF-INSTALLING

Maybe it's just a run of bad luck, but maybe hardware and software designers really are out to get me. Right here on my shelf is a promising CD-ROM application a vendor finally sent me after about a year of stalling. It's supposed to install itself using a runtime version of *Microsoft Windows*.

But it only *almost* installs itself. As far as I can tell, something weird happens

about 10 minutes into the sequence of batch files that does the installing. I can't see what, because the error message flies by too fast, and I can't fool around with the batch files because they're on a read-only disk. Too bad.

Then there's *Windows* itself. I install the free copy of *Windows/386* that came with my new machine. I fool around with it a bit, then decide to do no more until my serial mouse arrives.

When said rodent appears, *Windows* doesn't recognize it. But I assume there is a simple option on the Control Panel to tell *Windows* I've acquired a mouse. Wrong. You have to reinstall *Windows* from scratch—meaning floppy disks, meaning another 15 minutes down the drain. And the people who came up with this scheme are asking us to trust them with the future of microcomputing—also known as Presentation Manager.

Which at this writing has not yet arrived for my new machine, though it has been due in "just a matter of days" for about a month now. But at least it may solve one of the major failings of *Windows*, a failing shared with (or swiped from) the Macintosh desktop: a total lack of system-level

help. When you're looking at the basic screen, there's no key you can press or menu you can pull down to find out what to do next, and that next step is far from obvious to novice users. Getting at the system's Control Panel requires finding and running a file called CONTROL.EXE. Now that's ease of use!

But then maybe system help isn't needed at all, given the way some PM and Windows programmers talk. If they have their way, they'll isolate users from the system. They'll write their own help files (oh, sure they will). They'll make the world safe from independent thinkers who don't particularly care for the programs the company has foisted upon them. The more you talk with Windows and PM evangelists, the more the world sounds like 1973, when in-house programmers ruled the roost to the exclusion of users. "Use what we hand you and shut up."

Yeah, yeah, I know. I'm just being paranoid. The grinchers aren't stealing our machines, honest. So how come across the street, outside the house where they just installed a brand new microprocessor-controlled alarm system, eight cops are standing around scratching their heads?

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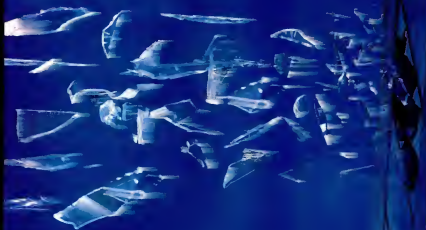
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*Release 3's 3D design lets you work with multiple sheets and files simultaneously.*

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**OUT IN FORCE**

**14 Machines**

with  
the

**SX**



**Promise**

*by Catherine D. Miller*

Intel introduced the 386SX chip to deliver 32-bit processing at an affordable price, so far with mixed results. Fourteen new machines aim for a price/performance mix that's more on target.

PHOTOGRAPH BY TECHNOLOGIA



Price is no longer a barrier to the 32-bit processing power of a 386 machine. One year after Compaq's introduction of its Deskpro 386S computer based on Intel's 80386SX microprocessor, the promise of 386 processing power at a 286 price is finally coming true.

Affordability and 32-bit processing power are the two ingredients meant to poise 386SX computers for success. The 80386SX chip combines the abilities of the 80386 and the 80286 chips. Like an 80386 chip, it processes instructions internally in 32-bit chunks. Like an 80286, it operates with a 16-bit data bus and a 24-bit address bus for support of 16MB RAM. This construction allows the 80386SX chip to run 386 software in essentially a 286 hardware environment.

Intel believes in a 32-bit world. The company wants the 80386SX to undercut the market for fast 286 chips now created by Harris and AMD. Indeed, fast 80286 chips from Harris and 80386SX chips from Intel are similarly priced. Harris sells its 16-MHz, 20-MHz, and 25-MHz 286 chips for \$72, \$89, and \$142, respectively. Intel sells its 16-MHz 80386SX chips for \$89. The competition between Intel and Harris (and AMD) for the midrange PC market will be intense, and these prices will continue to be very close.

But Intel may have the advantage. For one thing, Intel has designed the 80386SX chip so it is very cheap to manufacture. Based on low-power CHMOS II technology, it is packaged in a 100-lead surface-mount plastic quad flatpack. Bumpers on the corners protect the leads, thus allowing the chips to be packaged in tubes and mounted on boards by automatic handlers. And the design of the 80386SX allows it to access relatively slow and inexpensive memories effectively. As a result of its address pipelining scheme, a zero-wait-state system can be created with 100-ns. DRAM.

Clock speed isn't everything. Sure, a fast 286 may run faster than a 386SX, but it doesn't mean you'll get your work done faster. Why buy a 386SX rather than a fast 286 for a few hundred dollars less? The overwhelming reason is the software you can run on a 386SX that a 286 just can't handle. Environments like *DESQview 386*, *VM/386*, and *Microsoft Windows/386* and multitasking operating systems like Unix and Xenix make it possible to do true multitasking. Applications such as *Paradox 386*, *Interleaf Publisher*, and *Cadkey 3 Plus* are just a few that are now

being rewritten to support the 80386's capabilities. And memory managers like *QEMM-386* and *386-to-the-Max* allow you to take advantage of the memory-mapping abilities of the 80386. These software reasons for choosing a 386SX over a 286 are available today. You can bet developers will continue to concentrate on software written specifically for the 80386's advanced capabilities.

The 80386SX is already a relatively low-power CHMOS unit, but Intel's announcement of the low-power 16-MHz 80386SX designed for use in laptop machines should have a real effect on the 386 laptop market by requiring a smaller battery (meaning less weight). Intel has also

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announced the low-power 80387SX math coprocessor and the 82385SX cache controller to support it. Not only will the low-power chip be less temperature-sensitive, its idling mode will increase battery life by up to 25 percent. At \$107 the low-power chip costs 20 percent more than the 80386SX but \$83 less than the 80386 currently being used in laptops.

Intel expects to ship a 20-MHz 80386SX chip in early 1990. Because 16-MHz 386SX machines will be cheaper to produce than full-fledged 16-MHz 386 machines, the price point is likely to squeeze both the 16-MHz and 20-MHz 386 PCs out of the market. And the fast 286s will follow suit.

By the 1990s, slow 286 machines will constitute the very low end of the market, pushing the 8088/8086 into oblivion. PCs based on 16- and 20-MHz 386SX chips

will occupy the middle tier of computing power, pushing the more-expensive 16- and 20-MHz machines out of their niche. The high end of PC processing power will be held by the fast and powerful 25- and 33-MHz 386 machines. The 32-bit 80486's day in the sun will come later. Until software is written to take advantage of its built-in cache controller and math coprocessor, it will simply be a fast and expensive 386.

Buyers have been reluctant to invest in the SX because it offers questionable price/performance. For 386SX machines to take over the low end of the PC market and fulfill Intel's wish, prices need to be very competitive with fast 286 models and much lower than 386 models. And 386SX computers will have to represent a much better value than low-cost 286 machines.

Right now, 386SX PCs are only a few hundred dollars more than comparable 286s offered by the same company. In just about every instance the price of a 386SX is closer to the price of the company's 286 than to the 386. For example, the list price of Everex's 386SX model (the Everex Step 386is) in a basic configuration is \$2,799. A similarly configured 16-MHz 286 costs \$2,499 and a full-fledged 16-MHz 386 sells for \$3,699. Compaq sells its 12-MHz 286 Deskpro for \$2,699 in its basic configuration, while the Deskpro 386S goes for \$3,299. A 20-MHz Deskpro 386 sells for \$5,199.

IBM's significant price cuts in April—20 percent for its PS/2 Model 50Z and 8 percent for the Model 70-E61—will drive all PC prices even lower. And IBM is expected to announce its 386SX, the PS/2 Model 55 SX, for between \$3,000 and \$4,000, which is about \$3,000 less than its 386 machines.

One thing is certain. As the 286, 386SX, and 386 platforms vie for market share, computer buyers will be the big winners: prices will continue to drop.

#### THIRD-PARTY SUPPORT

Intel claims the demand for the 80386SX is greater than for any microprocessor the company has ever introduced. Although some analysts believe clone makers are waiting until IBM announces its 80386SX-based PS/2 Model 55 SX before developing 386SX machines, over 40 386SX computers have been announced. In the following pages, we review the first 14 to ship. A workstation from AST Research, a tiny footprint from Advanced Digital Corp. (ADC), laptops from NEC

Information Systems and Daewoo, and motherboards from DTK, Orchid Technology, Wave Mate, and ZyMOS have also been announced.

Chip set makers and BIOS developers are creating the support needed to build 386SX systems. Modifications to the 286 chip sets are needed because the 386SX chip has different timing from the 80286. Chip sets for the 386 cannot be used because the 386SX has narrower addresses and data buses. ACC Microelectronics, Chips and Technologies, G2, Intel, Western Digital/Faraday, and ZyMOS all offer 386SX chip sets at this time. VLSI has published the small modification needed for its chip set instead of creating a chip set specifically for the 386SX.

Austek has announced a cache controller designed for the 80386SX, while Intel and Advanced Logic Research (ALR) have been working together to modify Intel's 82385 for use in 386SX machines. ALR has integrated this cache controller into the ALR VIP SX386 and ALR Flex-Cache SX386Z reviewed in this issue. Among the 14 computers reviewed here, the two ALR offerings are the only ones that have cache controllers.

Although the Zeos 386-16/SX is the only computer reviewed in this early roundup of 386SX machines to use a 386SX-specific BIOS (Pro-386SX BIOS), the three largest BIOS creators—Phoenix, Award, and American Megatrends Inc. (AMI)—are all shipping their products to computer manufacturers. We'll soon begin to see 386SX machines with BIOSes tailored for the processing and I/O capabilities of the 80386SX chip. In the meantime, computer manufacturers have been tailoring existing BIOSes to work with their 386SX systems.

#### 286 TO 386SX

You don't have to buy a complete 386SX computer to upgrade to 32-bit processing power. Because the 386SX uses the same 16-bit data bus, memory, and supporting chips as 286 machines, it should be a simple matter to upgrade your 286 machine to a 386SX without completely sacrificing your current 286 investment. Since 80386SX and 80286 chips are different in size and construction, you cannot replace a 286 with a 386SX directly. But you could plug a daughtercard created for this purpose into the 80286 socket in order to avoid using a 16-bit slot.

Again, it's not a simple matter. For one thing, 80286 microprocessors come in

three different types of packages: PGA (Pin Grid Array), PLCC (Plastic Leadless Chip Carrier), and LCC (Leadless Chip Carrier). The type of 286 socket on your motherboard must match the connector on the daughtercard. Another consideration is timing. The BIOS is also important, especially in conjunction with a math coprocessor. And the location of the 286 socket plays a part; the daughtercard must sit in the 286 socket without interfering with other system devices.

Two machines included in this review, the Everex Step 386is and the Twinhead Superset 490, use daughtercards on their 16-MHz 286 motherboards to create new computers. Everex offers the In Step

**You don't have to buy  
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to upgrade a 286 unit  
to a 386SX.**

386SX daughtercard to current owners of Everex Step 286 computers—both 12-MHz and 16-MHz models—for \$699.

Cumulus Corp. and AOX both offer generic 386SX daughtercards to upgrade 286 machines. Cumulus's \$595 2- by 2-inch 80386SX Card will include a socket for an 80387SX math coprocessor and plug directly into a 286 socket. Cumulus anticipates versions with connectors for PGA- and PLCC-type sockets in two different orientations to work with most 286 systems.

AOX's StaX SX will come in versions with connectors for PGA, PLCC, and LCC sockets. Two 1½- by 1½-inch boards are joined together forming a stacked module: an adapter board with AOX's Cache Controller Chip and a socket connector, and the top board with the 80386SX, cache RAM chips, and a 32-

MHz crystal. The system also has support for the 387SX. The price for this module has not yet been determined.

SOTA Technology offers a \$645 add-in board to upgrade your 8088 or 8086 to 386SX capabilities. The SOTA 386si board offers 16K of cache memory and a socket for an 80387SX math coprocessor. It has a connector to attach SOTA's Memory/16i memory expansion card, offering 16-bit extended or expanded memory. A switch allows users to choose between 386SX and 8088 mode.

#### THE TOP FIVE

Among the five top PC manufacturers—IBM, Compaq, Epson, Tandy, and Zenith—only the Compaq Deskpro 386S was available at review time.

Tandy has announced a 386SX model called the Tandy 4000 SX. Zenith was researching different implementations of the 80386SX as this issue went to press, and Epson is looking at developing a 386SX machine for its Equity line of PCs. The IBM PS/2 Model 55 SX was announced too late to be included here. Its price is impressive in IBM terms: at \$3,895 for a VGA system with 2MB RAM and a 30MB hard disk, the machine underprices IBM's 386 offerings by about \$3,000. Its performance may leave something to be desired, but its compact design is ideal for buyers with the need to save space.

You'll find reviews of 14 386SX machines on the following pages. Many other 386SXs not reviewed here will be on the market by the time this issue is in your hands. AST Research is currently shipping a workstation, which we chose not to include in this roundup of full-fledged desktop 386SX machines. In addition to IBM and Tandy, at least 23 companies have announced systems based on the 80386SX but unavailable for this review: Acer Technologies Corp., Advanced Digital Corp., Arche Technologies, American Mitac Corp., Austin Computer Systems, Bargate, BSM, Core International, Daewoo, DMS Computers, DTK, Eltech Research, FiveStar Computers, Gateway Communications, GRiD Systems Corp., Maxar, Mitsubishi, Ogivar Technologies, Olivetti, PC Designs, QIC Research, Tandon Corp., and Tatung. Both American Mitac and Olivetti are designing MCA 386SXs in addition to classic-bus models.

#### PRODUCTS REVIEWED

In our first roundup of 386SX computers, we look at 14 machines from Advanced

## REAL ESTATE GUIDE TO THE PERFECT 386SX MACHINE

by Bill Howard

There's little reason for your PC to be much wider than your monitor. Now that manufacturers can put the video, disk drive controller, parallel port, serial port, and mouse port on the motherboard instead of on separate expansion cards, a small-footprint PC with three to four expansion slots and three to four half-height drive bays will satisfy all but the most fanatical power user. And the whole system unit will be only 15 to 17 inches wide instead of the 20 to 22 inches demanded by those aging wide-body PCs overwhelming your desk now. One of the most precious commodities in today's office (other than

functional photocopiers) is desktop real estate.

Many users will need slots for a network card and for a modem. That's two slots. You may need one slot for a video card if video support is not on the motherboard (an advantage, since Super VGA isn't available on motherboards yet). That's three. You may have use for a specialty card, such as a fax board or scanner or CD-ROM interface. That's four. The small-footprint machines in this review provide as many as eight slots.

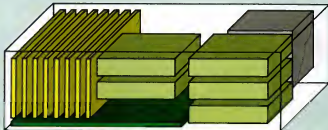
Mounting the expansion cards on their sides shaves an inch off the height of the system unit if you use four slots.

Some users find that when a monitor is perched atop a tallish PC, neck strain results, especially for those who wear bifocals.

The ideal small-footprint SX PC should be the size of IBM's PS/2 Model 55 SX: 14 inches wide, 4½ inches high, and 16 inches deep. And it should have room for 8MB of memory on the motherboard. Below are examples of how you can approach the PS/2 footprint without limiting yourself to 3½-inch drives and without resorting to the shorter Micro Channel cards. ■

*Bill Howard is an executive editor of PC Magazine.*

- Expansion slots
- Motherboard
- 5¼-inch drive bay
- 3½-inch drive bay
- Power supply



**Old faithful:** the classic wide-body. Eight slots on the left, two drive towers holding (typically) two and three half-height devices, respectively (the motherboard runs under the left-hand tower), power supply at right rear, three to five slots used for controllers and memory. Typical system size: 21 by 6¼ by 16 inches (dimensions are given in WHD format rather than the conventional HWD for easier small-footprint comparison). Examples in these reviews: Dell System 316, Swan 386SX, Mitsuba 386SX Workstation, NCR PC916SX, CPU 386/SX.

Logic Research (ALR), Club American Technologies, Compaq, Computer Products United (CPU), Dell, Everex, Mitsuba, NCR, NEC, Spear, Tussey, Twinhead, and Zeos. In separate sidebars we report on the Hewlett-Packard Vectra QS/16S, which was available only in a preproduction version at the time of this review, and on the NEC PowerMate Portable SX, which is currently the only available portable model built around the SX chip.

List prices for fully configured VGA systems with 1MB RAM, DOS, and a 60MB hard disk range from \$2,738 for Club American Technologies' Model 316SX to \$5,694 for NCR's PC916SX.

With computers bearing price tags like these, the 80386SX chip is beginning to live up to its promise of delivering 386 processing power at a 286 price.

**THE IDEAL 386SX**

What should you look for in a 386SX computer? Of course, performance and price are paramount. PC Labs' new series of benchmark tests, Release 5.0, debuts in this issue, so comparisons with results in past issues of *PC Magazine* are not valid. However, we've retested the landmark machines against which you're most likely to compare this group of PCs.

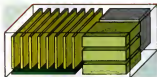
In the sidebar "Real Estate Guide to the Perfect 386SX Machine," we've put to-

gether what we consider the ideal 386SX computer, along these lines: The 386SX is designed to be an entry-level 386 computer offering midrange power, so it makes sense that it should be a small-footprint machine. Three half-height drive bays should be sufficient for the storage needs of the typical 386SX user. The motherboard should be able to handle 8MB RAM and should come with 800 by 600 VGA on the motherboard, as well as a floppy/hard disk controller and serial, parallel, and mouse ports. Four free slots, turned sideways to save even more desk space, should offer all the expandability you'll need. Most of the 386SX computers reviewed on the following pages are on the right track.

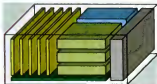




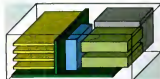
The perfect solution: four drives, four sideways slots. Two 5 1/4-inch bays allow for a 1.2MB floppy disk drive and a tape backup (or a half-height CD-ROM drive); two 3 1/2-inch bays hold a 1.44MB floppy disk drive and a hard drive. Video, parallel port, serial port, and mouse controller are on the motherboard, leaving all four slots free. This is the best combination of power and size, but no vendor makes a machine like this—yet. Size: 16–17 by 5 by 16 inches.



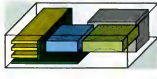
Three drives, six to eight slots. The most common configuration for a small-footprint machine. One drive lower holds three half-height devices atop each other, with the power supply in the back, and six to eight slots on the left. Examples: Club AT Model 316SX, HP Vectra QS/16S, Spear 386/16SX, Zeos 386-16/SX. Typical size: 17 by 6 by 16 inches.



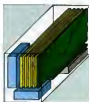
Three drives in one lower plus one hidden drive, five slots. By running the power supply along the length of the case on the right side, Compaq's Deskpro 386S puts the power switch in front and provides room for a fourth, 3 1/2-inch hard disk behind the drive lower. Controllers are integrated into the motherboard. Size: 15 by 6 by 16 inches.



Two drives plus one 3 1/2-inch drive turned on its side, four to six slots. Twinhead, NEC, and ALR follow this configuration. Twinhead mounts four expansion cards sideways, while ALR and NEC mount five and six vertically, respectively. Size: 16 by 6 (5 for the Twinhead Superset 490) by 16 inches.



Two side-by-side drives, three slots turned sideways, ultralow profile. Little bigger than power directors, these will make great diskless workstations as vendors release 386SX versions. Current 286 examples: Dell System 220, 15 by 4 by 16 inches (with 3 1/2-inch drive bays only), and Arche Parade, an inch wider, with one 5 1/4-, one 3 1/2-inch bay.



SX bread loaf. Not much bigger than a family-size loaf of bread at 6 by 6 by 16 inches, ALR's VIP SX386 has two 3 1/2-inch drives (one internal), a power supply along the base, and a backplane with five slots. It's more portable than some portable PCs.

#### ADVANCED LOGIC RESEARCH INC.

### ALR FlexCache SX386Z

### ALR VIP SX386

by Catherine D. Miller

Advanced Logic Research has made a name for itself in the 386 market by offering very fast and innovative computers at reasonable prices. In fact, *PC Magazine* honored the ALR FlexCache 25386, ALR's 25-MHz 386, by conferring upon it the 1988 Award for Technical Excellence

in the desktop machine category (*PC Magazine*, January 17, 1989).

The ALR FlexCache SX386Z is one of two ALR 386SX-based computers. For \$1,795 you get 512K RAM, a 1.44MB 3 1/2-inch floppy disk drive, and one serial and one parallel port. Upgrading to 1MB RAM while adding a 40MB hard disk and a monochrome graphics card bumps the price up to \$2,881; exchange the monochrome card for a VGA card and the list price becomes \$3,180.

You'll still need to add a monitor and DOS since ALR doesn't currently supply these items. But don't let those prices frighten you away. Because ALR sells through resellers, the price you'll pay may

be significantly lower than the list price.

The stylish small-footprint case—6.3 by 15 by 16.5 inches (HWD)—encloses two 3 1/2-inch and two 5 1/4-inch half-height drive bays. ALR manages to keep the width of its FlexCache SX386Z narrower than most small-footprint machines by positioning one 3 1/2-inch bay vertically next to the two stacked 5 1/4-inch bays. The other 3 1/2-inch bay, perfect for a hard disk, is mounted vertically in the rear of the machine. The three front bays are all accessible externally. In our review unit a 200-watt power supply sat directly behind the 5 1/4-inch bays, between the expansion slots and the rear 3 1/2-inch drive bay. Current FlexCache SX386Zs are being



ALR offers two 386SX alternatives: the FlexCache SX386Z (left) and the bread-loaf-style VIP SX386 (right). Both offer innovations: The FlexCache turned a drive on its side and put all RAM on a CPU card. The VIP is lighter than some portables and still accommodates five expansion slots and two drives. With 4MB of RAM and 40MB hard disks, these machines sell for \$5,055 and \$5,155, respectively.

shipped with a 150-watt power supply.

The computer is based on a modular design; its five 16-bit and one 8-bit expansion slot reside on a six-slot backplane. Both floppy and hard disk drive controllers are built into the backplane, as are a serial port and a parallel port. The 80386SX microprocessor, running at 16 MHz with no wait states, and a socket for the 80387SX math coprocessor are found on a CPU card in one of the 16-bit slots. This card is also home to system RAM and to ALR's proprietary caching system, based on Intel's 82385 cache controller.

A proprietary caching system is what made the earlier ALR 80386-based systems so fast. The ALR FlexCache SX386Z continues this grand tradition. This model and the ALR VIP SX386 proved the fastest two 386SX machines on PC Labs' processor-oriented tests: 80386 Instruction Mix and Floating-Point Calculation Without Coprocessor. ALR has tak-

en Intel's 16-MHz 82385 cache controller chip, which was designed for the 80386, and has modified it for optimum use with the 80386SX. Based on an associative two-way cache design, 16K of fast cache memory works with the cache controller to eliminate wait states by keeping frequently used data close at hand. The result is blazing 386SX performance. Intel's 386SX chip set and a Phoenix 80386 BIOS round out the CPU end.

In our evaluation unit, four of the eight SIMM columns were filled with 100-ns, 1MB SIMM packages, for a total of 4MB DRAM. Each bank consists of two columns. The CPU board handles up to 8MB RAM, in 256-kilobit and 1-megabit configurations. Although the system can handle 16MB RAM, it does not supply memory expansion cards. While the two ALR models were surpassed only by the Everex Step 386is in our Conventional Memory benchmark test, only the NEC Power-

Mate SX was slower accessing extended memory.

The idea behind the modular design is that you can easily upgrade your system by simply replacing the processor card with another more powerful card. An extra CPU card connector at the front end of a 16-bit slot allows for this special connection. Currently no other CPU cards are available for this system.

Our evaluation unit came equipped with TEAC's 1.44MB 3½-inch floppy disk drive and a 40MB Miniscribe hard disk. The hard disk's performance on our benchmark tests was somewhat disappointing, placing near the bottom in our large-record DOS File Access test. It did better with small records, placing roughly in the middle. And that disk is not inexpensive—\$699 for 40MB.

The system we reviewed came with ALR's 16-bit VGA card based on the Paradise PVGA1A controller chip. In addition to displaying 16 colors in extended 800 by 600 resolution, ALR's VGA card supports 132-column text mode. It includes drivers for Microsoft Windows, GEM, AutoCAD, Lotus 1-2-3, and Ventura Publisher, among others; it also includes both a 15-pin analog and a 25-pin digital connector. The ALR FlexCache SX386Z turned in solid performances in all three of our video benchmark tests, easily placing in the top half of the systems tested.

The keyboard provided by ALR has low keys with a nice clicky feel and is pleasant to type on.

ALR's setup program makes it easy to decide how you want your system configured. For example, you can choose to enable or disable shadow video and BIOS RAM from a clearly rendered menu. The FlexCache SX386Z manual guides you through system setup just as it details upgrading your system step by step. An index, glossary, and table of contents direct you to the information you need.

With the exception of its mediocre and relatively expensive hard disk, the ALR FlexCache SX386Z is a well-designed system that boasts true 386 performance.

#### ALR VIP SX386

For weeks PC Labs was abuzz with talk of the ALR VIP SX386. This machine is probably the smallest PC we've had our hands on. Measuring in at a diminutive 8.5 by 4.5 by 16 inches (HWD) and weighing only 17 pounds, the VIP is a marvel of clever engineering. With a list price of \$1,895 for a system with 512K RAM and a

1.44MB 3½-inch floppy disk drive, it's light on your budget too.

Like the ALR FlexCache SX386Z, the VIP SX386 is based on a modular design. A 386SX CPU card takes up one of four 16-bit expansion slots on a 5-slot backplane; the fifth slot is 8-bit. In fact, the 386SX CPU card is the same one included with the FlexCache SX386Z system—complete with ALR's 16K RAM proprietary cache. The backplane is only slightly smaller, though significantly different. Controllers for one floppy disk drive and one hard disk are built into the backplane, as is one serial port.



## FACT FILE

Advanced Logic Research Inc., 9401 Jeronimo Rd., Irvine, CA 92718; (800) 444-ALR, (714) 561-6770.

## ALR FlexCache SX386Z

**List Price:** With 512K RAM, 1.44MB 3½-inch floppy disk drive, \$1,795; with 1MB RAM, 40MB hard disk, monochrome adapter, \$2,881; with VGA adapter, \$3,180; with 4MB RAM, \$5,055.

**In Short:** The ALR FlexCache SX386Z's attractive small-footprint case houses a fast system designed around ALR's proprietary cache. The FlexCache utilizes a modular design with all RAM and the 80386SX on a CPU card. A good value apart from the slow and relatively expensive hard disk.

CIRCLE 542 ON READER SERVICE CARD

## ALR VIP SX386

**List Price:** With 512K RAM, 1.44MB 3½-inch floppy disk drive, \$1,895; with 1MB RAM, 40MB hard disk, monochrome adapter, \$2,981; with VGA adapter, \$3,280; with 4MB RAM, \$5,155.

**In Short:** ALR's VIP SX386 is the most distinctively designed machine of the bunch. It also sports ALR's incredibly fast caching system, and turned in great performances in all but the hard disk and extended memory benchmark tests. The VIP's modular design makes upgrades to a 386 system board a simple matter.

CIRCLE 543 ON READER SERVICE CARD

The backplane is mounted on top of the 65-watt power supply in the rear of the system. A 3½-inch drive mounting area, which is not accessible from the front of the system, sits to the front of the power supply. Currently, only 40MB Miniscribe drives are available from ALR, but 100MB drives should be available in the near future.

A TEAC 1.44MB floppy disk drive is installed in the vertical 3½-inch mounting area in the front of the machine atop a small fan. Unlike the FlexCache SX386Z, the VIP SX386 has its power switch at the rear of the machine. Two LED indicators

for power and hard disk access sit next to the fan.

The 386SX CPU card in our evaluation unit was identical to the one in the FlexCache SX386Z, as were the 16-bit VGA card, hard disk, floppy disk drive, and keyboard. Not surprisingly, the performance of the two ALR machines on our benchmark tests was comparable.

Two other CPU cards are currently available for the VIP. The VIP 12286 is based on Intel's 12.5-MHz 80286 microprocessor, with support for the 8-MHz 80287 math coprocessor. Intel's 20-MHz 80386 chip is the engine for the VIP 20386, which supports the 20-MHz 80387 coprocessor.

The ALR VIP SX386 has a truly unique design, and it is also one of the better price/performance values among the computers we reviewed. You've got to see it to believe it.

## CLUB AMERICAN TECHNOLOGIES

## Club AT Model 316SX

by Catherine D. Miller

At \$2,285 for a monochrome system with 1MB RAM, an 80MB hard disk, and DOS 3.3, the Club AT Model 316SX is priced to sell. And if you're not impressed already, listen to this: Club American's basic-configuration model, which includes 1MB RAM without display or hard disk, goes for an incredible \$1,460. And this low-priced offering doesn't skimp on extras; it also features attractive styling, some interesting design features, and solid benchmark-test performance.

The front panel includes a membrane-type reset switch and a speaker on/off switch. The power, turbo, and hard disk LED indicators are also located on the front panel. The power switch is located on the rear right side of the case.

Keys on the XT/AT switchable keyboard are low, although they are sufficiently separated from one another. The keyboard is a bit on the mushy side and lacks a clicky feel.

Housed in the 6.3 by 17 by 16.8-inch (HWD) case are three 5½-inch half-height drive bays, two of which are accessible from the front. Our review unit included TEAC's 1.2MB floppy disk drive and a 80MB hard disk from Maxtor. The sys-

tem's Omti ST-506/412 controller can handle a total of two floppy disk drives and two hard disks.

While the Model 316SX's overall performance on our benchmark tests was pretty good, the disk benchmark tests ranked in the lower half of the pack. The disk caching utility *SpeedCache* from Storage Dimensions was included with the system we reviewed; you'll probably want to use it to top up performance a bit.

Behind the drive bays sits the Skynet Electronic 200-watt power supply. Like the Dell System 316, the Club AT Model 316SX has a quick reference guide that adheres to the top surface of the power supply inside the computer. Besides giving a diagram of the system's basic features, this guide shows you where to find several video, memory, and math coprocessor jumpers and switches, and also gives you some guidance in dealing with the most-common circumstances. This kind of guide is helpful when it is time to upgrade your system; there's no need to hunt down the manual to determine which jumpers need to be reset.

Unfortunately, it's impossible for the internal quick reference guide to include all the jumpers and switches that might need to be changed with a change of equipment. The board, designed by Club American Technologies, has nine switches and jumpers. Although switches and jumpers didn't need to be changed in the unit we reviewed, jumpers were set for the highest



## FACT FILE

## Club AT Model 316SX

Club American Technologies, 3401 West Warren Ave., Fremont, CA 94539; (415) 683-6600.

**List Price:** With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$1,460; with 80MB hard disk, monochrome monitor, DOS 3.3, \$2,285; with VGA monitor, \$2,738; with 2MB RAM, 80387SX coprocessor, \$3,253.

**In Short:** Club American Technologies' attractive Model 316SX is the lowest-priced fully configured system reviewed in this roundup of 386SX machines. It also turned in better-than-average benchmark test performances.

CIRCLE 544 ON READER SERVICE CARD

number of bus wait states. To improve bus throughput, you'll have to set those jumpers for the smaller number of wait states. In addition, any change in memory configuration will require a change in switch settings and you'll have to refer to the manual to determine what changes need to be made. Club American Technol-



An impressive value, the small-footprint Club AT Model 316SX costs only \$2,738 with 1MB of RAM, an 80MB hard disk, and a VGA monitor. This eight-slot, three-drive-bay box delivers respectable performance to complement its rock-bottom price.

ogies says it is now working on what will be a welcome change: a board with no jumpers or switches.

In addition to two 8-bit and four 16-bit slots, the Model 316SX motherboard has two proprietary 16-bit slots for Club American Technologies' 16-MHz memory cards. Memory cards are available with configurations of 1MB, 2MB, 4MB, or 8MB RAM. Oddly enough, these slots will also run 8-bit expansion cards, but not ordinary 16-bit cards. If for whatever reason you don't want to add to the 2MB RAM available on the motherboard you are left with four 8-bit and four 16-bit slots; I would have liked to see fewer 8-bit slots and more 16-bit capabilities. The system we reviewed was fully populated with 2MB 100-nanosecond DRAM on the motherboard and no slotted RAM.

The 80386SX microprocessor runs at 16 MHz with zero wait states and is software-switchable down to 8 MHz. Like several other machines in this roundup, the Model 316SX relies on the AMI 386

BIOS. It also includes the Dallas Real Time 8835 clock chip, which has a life span rated at 10 years.

Our \$3,253 evaluation unit came equipped with an 80387SX math coprocessor, along with Club American's adaptation of the Video Seven 16-bit VGA card and a NEC Multisync II monitor. This popular duo makes for dynamic VGA graphics. Even though we did not load the VGA card's RAMBIOS.SYS driver, which loads video BIOS into system RAM (known as video shadow RAM), the Model 316SX was a fast performer in our video benchmark tests.

The manual contains all the information about the system you might need, though a bit jumbled in places, and includes a good table of contents and index. A table outlining the functions of all the switches and jumpers but not the default settings is followed by a more detailed discussion.

Club American Technologies' Model 316SX is a solid machine offering a strong value for your SX dollar.

#### COMPAQ COMPUTER CORP.

### Compaq Deskpro 386S

by Henry Fersko-Weiss

The Compaq Deskpro 386S takes a lot of liberties with the price/performance equation. With a base price of \$3,299 and a VGA system cost of \$5,018, the Deskpro 386S rides very near the top of the cost curve. Yet its processor, memory, and hard disk performance are undistinguished. Stretching the equation in these two directions at once doesn't make this Compaq machine look like a smart buy. But these numbers lose some of their significance when you add in the intangibles: Compaq's superior quality of construction, the efficiency of its design, and its reputation for service.

A close look at the Compaq's performance on our benchmark tests reveals a machine that operates at both ends of the spectrum. The processor turned in some of the slowest times. The conventional memory performance was the slowest of all, yet the extended memory proved to be the fastest. The hard disk performance was a little better than average. But when it came to our video tests, the Deskpro 386S was always among the top three. The superfast video may compensate for the slow processor, but the combination of comparatively slow conventional memory, hard disk, and processor is likely to be perceptible to the user.

Computers cannot be judged solely on

#### PC FACT FILE

**Compaq Deskpro 386S**  
Compaq Computer Corp., 20555 FM 149,  
Houston, TX 77070; (713) 370-0670.  
List Price: With 1MB RAM, 1.2MB 5 1/4-inch  
floppy disk drive, \$3,299; with 20MB hard disk,  
\$3,799; with 40MB hard disk, \$4,199; with  
monochrome monitor, DOS 3.31, \$4,574; with  
VGA monitor, \$5,018; with 40MB tape backup,  
1.2MB 5 1/4-inch and 1.44MB 3 1/2-inch floppy disk  
drives, \$5,092.

**In Short:** The Compaq Deskpro 386S is one of the most expensive computers in its category, even though its performance is in general unimpressive. These factors are somewhat counterbalanced by the quality of the design and construction. For example, all the basic I/O functions, such as video, serial, and parallel ports and the floppy/hard disk controller are built right onto the motherboard.

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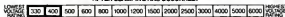
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more, its Preview feature wipes out wasted printing runs by showing what a report will look like before it's printed. Professional Write even shares files with other popular word processing programs. And supports high quality laser and dot matrix printers, providing managers access to a flood of fonts. So call today for a free trial disk. Professional Write will have managers instantly producing sophisticated documents, instead of wringing their hands over complicated software.

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The Compaq Deskpro 386S runs a high tab for middling performance, but with so many components incorporated into the motherboard and with the Compaq name on the box, the extra cash may be worth it. A system with 1MB of RAM, a 40MB hard disk, and a VGA monitor costs \$5,018.

operational performance and price. The quality of the construction, the longevity of components, the machine's expansion capabilities, and the available service must also be considered. In all of these respects Compaq's 386S computer stands out.

Getting inside the computer is easy. There are only three thumbscrews holding the case to the chassis, which are easily unscrewed by hand once you get them started. Because they stay attached to the rear panel, you don't have to worry about dropping them into the machine or losing them. The screws that hold the plates covering the expansion slots, however, are another story. They are Torx screws, so you need a special screwdriver to remove them—not necessarily a common item to have lying around.

The computer's chassis is supported front to back by the metal case of the 140-watt power supply, which runs the entire depth of the machine. The small footprint—5.9 by 15.8 by 14.8 inches (HWD)—means that there is less play in the frame, motherboard, and case. The four drive bays are encased in a sturdy

metal shell to protect them further.

There are only five expansion slots in the 386S. They all take 16-bit cards, but one of them is a proprietary high-speed slot reserved for memory expansion. The Deskpro 386S has two high-speed memory cards, one with 1MB RAM and the other with 4MB, to which you can add 1MB or 4MB memory modules. When you add these to the 1MB of 80-nanosecond RAM on the motherboard, the most memory you can swing is 13MB.

The system memory comes in either of two configurations: eight 4-by-256-kilobit chips with four 1-by-256-kilobit chips for parity, or 36 1-by-256-kilobit chips. The memory uses an enhanced page-mode scheme. Paged operations occur with zero wait states, while nonpaged operations have two wait states. On the average the system operates at 0.8 wait states.

The number of slots in this computer may seem limiting at first, but everything you commonly need is built in. The serial, parallel, and mouse ports come off the motherboard (manufactured by Compaq), as does the video controller and the floppy/hard disk controller.

Therefore the slots are available for other peripheral controllers to operate such devices as a modem, scanner, or LAN hookup.

The Deskpro 386S comes in three models. The basic configuration has a 1.2MB 5¼-inch floppy disk drive. The Model 20 has a 20MB ST-506/412 MFM hard disk in addition; the Model 40 has a 40MB ST-506/412 RLL hard disk. All three include 1MB of RAM; the video controller; the floppy/hard disk controller; serial, parallel, and mouse ports; an AT-style Enhanced keyboard; disk cache software; and Compaq Expanded Memory Manager software. The basic model costs \$3,299; the Model 20 costs \$3,799, and the Model 40 costs \$4,199.

When you add a 40MB tape backup unit, a 1.44MB 3½-inch floppy disk drive, a VGA monitor, and Compaq's version of DOS, Release 3.31 (which lets you configure your entire hard disk as one volume), as in our test configuration, the price goes up to \$6,092.

Three of the four drive bays are accessible through the front of the computer. In addition to the 40MB tape backup unit we saw, Compaq offers a 135MB tape drive. The fourth drive bay, which is positioned sideways and behind the other three, houses the hard disk. A second hard disk can be added to the bottom front drive bay. In addition to those that come in the Models 20 and 40, Compaq offers a 110MB RLL drive. Just to the right of the drive bays is the on/off switch and the LED lights for the power and hard disk. The system's lock is in the rear panel.

Attached is the original AT-style keyboard with its smaller Enter key and larger Backslash key under the Backspace key. Unlike most newer keyboards, this one has the LED lights for NumLock, CapsLock, and ScrollLock on the individual keys rather than together in a little panel display. The keys have a flat response with a muted clicking sound.

Compaq offers two types of monitor, both analog devices with a text resolution of 720 by 400 and a graphics resolution of 640 by 480. The VGA monitor we reviewed had a screen that measured 13.25 inches on the diagonal and stood 14 inches high on a swivel base. The on/off switch is well positioned on the front face. I found the contrast range on the monitor somewhat limited.

It's hard to come to a clear judgment on the Compaq Deskpro 386S computer. While a fully configured unit is more ex-

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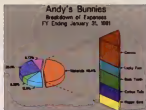
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and compatible computers but also takes full advantage of 286 and 386 machines when you decide to make that transition.

And if all that isn't enough to make you run out today and join the revolution, there's even more incentive.

Like our free demo disk offer through July 31, 1989. And our \$100 upgrade offer for just about any spreadsheet you're using. Call 1-800-531-5236. In Canada call 1-800-663-6904.

Which finally brings us to our admittedly biased outlook for the much touted spreadsheet war. With SuperCalc5, peace is at hand.

## Andy's Business

Income Statement  
For the year ending 12/31/88

Revenue	Expenses	Profit
Sales		
Retail	\$1,200,000	
Wholesale	800,000	
Licensing	200,000	
Total Revenue	2,200,000	
Cost of sales		
Manufacturing	1,000,000	
Distribution	100,000	
Marketing	50,000	
Total Cost of Sales	1,150,000	
Gross Profit		1,050,000
Operating Expenses		
Salaries	400,000	
Rent	100,000	
Utilities	50,000	
Travel	20,000	
Advertising	100,000	
Depreciation	50,000	
Interest	20,000	
Income taxes	100,000	
Total Operating Expenses	840,000	
Operating Profit		210,000
Non-Operating Income		
Interest income	10,000	
Dividend income	20,000	
Capital gains	50,000	
Total Non-Operating Income	80,000	
Net Income		290,000

Produce annual report quality output everyday

Letting you easily move 1-2-3 macros into SuperCalc5 and back again. Even toggling between menus is a snap for SuperCalc5.

But not for Excel®.

Which now brings us to the "E" word. Unlike Excel, SuperCalc5 runs on all IBM®

Microsoft. IBM is a registered trademark of International Business Machines.



COMPUTER  
ASSOCIATES  
Software superior by design.



# 386SX-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

	CPU 386SX	Club AT Model 316SX	Swan 386SX	Spear 386/16SX
<b>BASIC CONFIGURATION</b>				
List price	\$1,295	\$1,460	\$1,499	\$1,659
Basic configuration includes	512K RAM, 1.2MB or 1.44MB floppy disk drive, two serial and one parallel port	1MB RAM, 1.2MB floppy disk drive, one serial and one parallel port	1MB RAM, 1.2MB or 1.44MB floppy disk drive, one serial and one parallel port	1MB RAM, 1.2MB floppy disk drive, one serial and one parallel port
Drive bays	5 half-height	3 half-height	5 half-height	3 half-height
Cost of DOS 3.3 / OS/2 (if available)	\$85/Unavailable	\$70/Unavailable	\$89/Unavailable	\$69/\$300
Hard disk options	9	6	4	9
Slots	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit
Slots free with hard and floppy disk drives, video, two serial and one parallel port installed	4	4	5	5
Power supply (watts)	200	200	200	200
Reset switch	●	●	●	●
Switchless setup	●	●	●	●
Keyboard cable length (inches)	72	124	124	132
<b>STANDARD CONFIGURATION</b>				
Price of monochrome system with 1MB RAM, 60MB hard disk, DOS	\$2,230	\$2,285 (80MB disk)	\$2,349 (80MB disk)	\$2,343 (44MB disk)
Price of VGA system	\$2,980	\$2,738 (80MB disk)	\$2,848 (80MB disk)	\$2,899 (44MB disk)
<b>TESTED CONFIGURATION</b>				
List price with DOS	\$3,885	\$3,253	\$2,937	\$2,899
Tested configuration includes	2MB RAM, 44MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387SX coprocessor	2MB RAM, 80MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387SX coprocessor, SpeedStor, SpeedCache	2MB RAM, 80MB hard disk, 1.2MB floppy disk drive, VGA monitor	1MB RAM, 44MB hard disk, 1.2MB floppy disk drive, VGA monitor
Microprocessor clock speeds	16 MHz	8/16 MHz	8/16 MHz	16 MHz
Bus clock speeds	10 MHz	3.6/7.1 MHz	8 MHz	8 MHz
Wait states	0	0	0	0
Disk controller manufacturer and type (interface/encoding)	DTC (ST-506/RLI)	OMTI (ST-506/MFM)	Adaptec (ST-506/MFM)	Scientific Micro (ST-506 MFM)
Number of drives handled by controller	4	4	4	4
BIOS version and date	Award BIOS, Version 3.03 (March 1988)	AMI 386 BIOS (November 1988)	Chips and Technologies BIOS, Version 1.0 (1988)	AMI BIOS, Version F136 (February 1989)
System board manufacturer	Standard Computer	Everex	KeyTronic	Everex
386 chip set manufacturer	Chips and Technologies	None (uses discrete logic)	Chips and Technologies	Intel

■—Editor's Choice ●—Yes ○—No N/A—Not applicable: the machine is not available in this configuration.

**COMPUTERS**  
**80386SX-BASED PCs**

pensive than all but two SX machines, the NCR PC916SX and the NEC PowerMate SX, and its performance results aren't impressive, the machine is very well constructed; it has ample room for expansion and boasts Compaq's usual stamp of quality in manufacture. On a raw price/performance basis this machine may not be worth the investment, but when you factor in the longevity of the computer and its possible resale value it may well be a good buy. It's the same kind of decision you'd have to make in deciding between buying a Volvo and a Hyundai.

**COMPUTER PRODUCTS  
UNITED INC.**

**CPU 386/SX**

by Susan L. Hayes

If Computer Products United could rewrite an old cliché to describe the CPU 386/SX, it would read, "Fast and steady wins the race." This desktop model is a typically laid out machine that offers few surprises in structure and design; even CPU claims its SX looks like any other 16-MHz 80386SX-based PC. It seems able to do what other SX machines do, only better and faster. You won't exactly have to

**You won't exactly have  
to break your piggy  
bank for the CPU  
386/SX, and you get  
good performance for  
your outlay.**

break your piggy bank for this one, and you get good performance for your relatively modest outlay.

If you want a guided tour of this SX machine, you probably will want to go to someone other than CPU. The accompanying setup manual and documentation give new meaning to the word *generic*. The documentation doesn't exactly go out of its way to explain much about the specific SX product. The material evidently

**Twinhead  
Superset 490**

\$1,699  
1MB RAM; 1.2MB  
floppy disk  
drive; one  
serial, one  
parallel, and one  
mouse port  
3 half-height

\$70/Unavailable  
2  
One 8-bit,  
three 16-bit  
4

150

●

○

76

N/A

N/A

\$2,999

1MB RAM, 40MB  
hard disk, 1.2MB  
floppy disk  
drive, VGA card,  
mouse

8/16 MHz

8 MHz

0

Twinhead  
(ST-506/MFM)

4

Phoenix BIOS,  
Version 3.10  
(January 1989)

Twinhead

Chips and  
Technologies

**ALR FlexCache  
SX386Z**

\$1,795  
512K RAM, 1.44MB  
floppy disk  
drive, one  
serial and one  
parallel  
port

4 half-height

Both unavailable

1

One 8-bit, five  
16-bit

4

200

○

●

132

N/A

N/A

\$5,055

4MB RAM, 40MB  
hard disk,  
1.44MB floppy  
disk drive, VGA  
card (DOS not  
included)

8/16 MHz

8 MHz

0

ALR (ST-506/MFM)

4

Phoenix BIOS  
Plus, Version 1.10  
(January 1989)

ALR

Intel

**ALR VIP SX386**

\$1,895  
512K RAM, 1.44MB  
floppy disk  
drive, one  
serial port

2 half-height  
mounting areas

Both unavailable

1

One 8-bit, four  
16-bit

3

65

○

●

132

N/A

N/A

\$5,155

4MB RAM, 40MB  
hard disk,  
1.44MB floppy  
disk drive, VGA  
card (DOS not  
included)

8/16 MHz

8 MHz

0

ALR (ST-506/MFM)

2

Phoenix 80386 BIOS  
Plus, Version 1.10  
(September 1988)

ALR

Intel

CONTINUES



## 386SX-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

	Zeos 386-16/SX	Mitsuba 386SX Workstation	Everex Step 386is	NEC PowerMate SX
<b>BASIC CONFIGURATION</b>				
List price	\$1,895	\$2,145	\$2,799	\$2,899
Basic configuration includes	512K RAM, 32MB hard disk, 1.2MB floppy disk drive, monochrome monitor, one serial and one parallel port	1MB RAM, 1.2MB floppy disk drive, one serial and one parallel port	1MB RAM, 1.2MB floppy disk drive, one serial and one parallel port, DOS 3.3	2MB RAM, 1.2MB or 1.44MB floppy disk drive, one serial and one parallel port, DOS 3.3, Microsoft Windows/386
Drive bays	3 half-height	5 half-height	3 half-height	3 half-height
Cost of DOS 3.3 / OS/2 (if available)	\$98/Unavailable	\$99/Unavailable	Included/\$325	Included/\$325
Hard disk options	10	4	4	3
Slots	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	One 8-bit, seven 16-bit	One 8-bit, five 16-bit
Slots free with hard and floppy disk drives, video, two serial and one parallel port installed	5	5	5	3
Power supply (watts)	230	200	200	193
Reset switch	●	●	●	○
Switchless setup	●	●	●	○
Keyboard cable length (inches)	110	115	132	132
<b>STANDARD CONFIGURATION</b>				
Price of monochrome system with 1MB RAM, 60MB hard disk, DOS	\$2,392 (65MB disk)	\$2,995 (71MB disk)	\$3,827 (80MB disk)	N/A
Price of VGA system	\$3,087 (65MB disk)	\$3,895 (71MB disk)	N/A	\$4,949 (2MB RAM, 42MB disk)
<b>TESTED CONFIGURATION</b>				
List price with DOS	\$3,532	\$4,420	\$6,393	\$4,949
Tested configuration includes	1MB RAM, 32MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387SX coprocessor, DOS 4.01	2MB RAM, 71MB hard disk, 1.2MB floppy disk drive, VGA monitor	2MB RAM, 160MB hard disk, 1.2MB floppy disk drive, EGA monitor, 80387SX coprocessor	2MB RAM, 42MB hard disk, 1.2MB floppy disk drive, VGA monitor, Microsoft Windows/386
Microprocessor clock speeds	8/16 MHz	16 MHz	5/8/16 MHz	16 MHz
Bus clock speeds	8 MHz	8 MHz	5.3/7.7/8 MHz	8 MHz
Wait states	0	0	0	0
Disk controller manufacturer and type (interface/encoding)	Adaptec (ST-506/RLI)	Seagate (ST-506/MFM)	Control Data (ESDI)	Western Digital (ST-506/MFM)
Number of drives handled by controller	4	4	4	4
BIOS version and date	Pro-386SX BIOS, Version 4.35 (March 1989)	AMI BIOS, Version 1131 (February 1989)	Everex BIOS (derived from AMI; February 1989)	Phoenix BIOS, Version 1.10.54 (January 1988)
System board manufacturer	Progressive	Mitsuba	Everex	NEC
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	None (uses discrete logic)	Intel

Editor's Choice 
 Yes 
 No 
 N/A—Not applicable: the machine is not available in this configuration.



COMPUTERS  
80386SX-BASED PCs

Dell System 316	Compaq Deskpro 386S	NCR PC916SX
\$2,999	\$3,299	\$4,995
1MB RAM, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive, monochrome monitor, two serial and one parallel port	1MB RAM, 1.2MB floppy disk drive, one parallel and one mouse port	1MB RAM, 44MB hard disk, 1.44MB floppy disk drive, one serial and one parallel port, DOS 3.3
5 half-height	4 half-height	5 half-height
\$100/\$325	\$120/\$340	Included/\$325
4	3	3
Two 8-bit, six 16-bit	Five 16-bit	Two 8-bit, six 16-bit
7	5	6
200	140	220
●	○	●
132	104	128
\$3,099 (40MB disk)	\$4,574 (40MB disk)	\$5,250 (44MB disk, VGA monochrome monitor)
\$3,599 (40MB disk)	\$5,018 (40MB disk)	\$5,694
\$4,299	\$6,092	\$5,694
1MB RAM, 100MB hard disk, 1.44MB floppy disk drive, VGA monitor	1MB RAM, 40MB hard disk, 40MB tape backup, 1.2MB and 1.44MB floppy disk drives, VGA	1MB RAM, 44MB hard disk, 1.44MB floppy disk drive, VGA monitor
8/16 MHz	16 MHz	16 MHz
8 MHz	8 MHz	8 MHz
0	0	1
Conner Peripherals (ST-506/RLL)	Conner Peripherals (ST-506/RLL)	NCR (ST-506/MFM)
5	4	4
Phoenix BIOS, Plus, Version 1.10 (January 1989)	Compaq BIOS, Version N.2 (June 1988)	NCR BIOS, Version 7.2 (January 1989)
Dell	Compaq	NCR
Chips and Technologies	Compaq	Intel

CONTINUES

applies to all of CPU's machines, with a few pages stuck in the back listing the specs of the machine in question. The text does cover many universal topics well, such as installing drives and adding adapters, and there is a helpful troubleshooting guide to help you in your time of need, so you're not left completely on your own.

Another potential motto for the CPU SX machine could be "Safety first." The reset button must be pressed down for at least 1½ or 2 seconds before it will actually reset the machine. And CPU doesn't overlook certain convenience features such as switchless setup in ROM, which can save you time and hassle.

On the Hi-Tek Enhanced-style keyboard everything is where it should be, but

PC  
MAGAZINE  
FACT FILE

CPU 386/SX

Computer Products United Inc., 12803 Schabrum Ave., Irwindale, CA 91706; (800) 824-2936, (800) 862-6111 (in Calif.).

List Price: With 512K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, \$1,295; with 1MB RAM, 60MB hard disk, monochrome monitor, DOS 3.3, \$2,230; with VGA monitor, \$2,980; with 2MB RAM, 44MB hard disk, 80387SX coprocessor, \$3,885.

In Short: The CPU SX system is a standard clone that offers few surprises. Without having to part with too much of your hard-earned cash, you'll get a decent, competitive machine. Its brand-name parts mean that reliability and quality are part of the package too.

CIRCLE 548 ON READER SERVICE CARD

the keys feel mushy to the touch and the response seems a bit sluggish.

The architecture of the Standard Computer Corp. motherboard, backed by an 18-month warranty (there's 1 year on the total system) is based on a Chips and Technologies chip set. The motherboard holds a small plug-in board where lies the 16-MHz Intel 80386SX chip. The motherboard is removable and can be replaced by an 80286-20 coprocessor board, so you can easily convert to a 286-20 computer if this unlikely need should arise. There are eight expansion slots on the motherboard (six 16-bit and two 8-bit), but because of the processor board you can place only a short expansion card in one of the 8-bit slots. The two serial, one parallel, and one game port reside on a short I/O card.

The base system uses two banks of 256-kilobit SIMM chips to achieve 512K RAM, but the CPU 386/SX can hold 8MB on board and up to 16MB of total system memory (using 1-megabit SIMM chips



## 386SX-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

MEMORY SPECIFICATIONS	CPU 386/SX	Club AT Model 316SX	Swan 386SX	Spear 386/16SX
Memory chip type	256Kb, 1Mb	256Kb	256Kb, 1Mb	256Kb
Chip packaging	SIMM	DIP	SIMM	DIP
RAM chips	DRAM	DRAM	DRAM	DRAM
Interleaved memory	●	○	●	○
Shadow RAM	BIOS and video	Video	BIOS	None
Type of cache controller	None	None	None	None
Disk cache software	●	●	○	○
Maximum RAM on motherboard	8MB	2MB	8MB	2MB
Maximum total system RAM	16MB	16MB	16MB	16MB
OTHER				
Warranty	1 year; 18 months for motherboard	1 year	1 year	1 year
FCC certification class	A	B	A	B

MEMORY SPECIFICATIONS	Zeos 386-16/SX	Mitsuba 386SX Workstation	Everex Step 386is	NEC PowerMate SX
Memory chip type	64Kb, 256Kb, 1Mb	256Kb	256Kb, 1Mb	1Mb
Chip packaging	SIMM	DIP	DIP	SIP
RAM chips	DRAM	DRAM	DRAM	DRAM
Interleaved memory	●	●	○	●
Shadow RAM	BIOS and video	BIOS and video	BIOS and video	BIOS and video
Type of cache controller	None	None	None	None
Disk cache software	○	○	●	●
Maximum RAM on motherboard	8MB	2MB	4MB	2MB
Maximum total system RAM	16MB	10MB	16MB	16MB
OTHER				
Warranty	1 year	1 year	1 year	1 year
FCC certification class	A	A	B	B

Editor's Choice 
 ●—Yes ○—No

running at 100 nanoseconds). The system also offers 384K shadow RAM to help speed up video output.

Our tested unit came equipped with a Toshiba 40MB hard disk; 20MB to 330MB hard disks are also available. The ST-506/RLL controller, manufactured by DTC, has a 1:1 interleave, which allows the CPU system to reach zero wait states. Computer Products United also includes EMS 4.0 memory with the system. The

**The CPU 386/SX is  
a solid and predictable  
collection of brand-  
name parts made to get  
the job done without  
fancy footwork.**

CPU uses the Award BIOS and maintains a bus speed of 10 MHz.

The 200-watt power supply comes equipped with a 110/220-volt switch on the outside of the case. The machine has five half-height drive bays, three of which have exposed fronts.

CPU's base-system price may start off impressively low, but you would be getting quite a skeletal system. The company offers so many different configurations

Twinhead Superset 490	ALR FlexCache SX386Z	ALR VIP SX386
256Kb, 1Mb	256Kb, 1Mb	256Kb, 1Mb
SIMM	SIMM	SIMM
DRAM	DRAM	DRAM
●	○	○
BIOS and video	BIOS and video	BIOS and video
None	ALR (16K)	ALR (16K)
○	●	○
8MB	8MB	8MB
16MB	16MB	16MB
13 months	1 year; 3 years for system board	1 year
A	A	A

Dell System 316	Compaq Deskpro 386S	NCR PC916SX
256Kb, 1Mb	256Kb, 1Mb	256Kb
SIMM	SIMM	SIMM
DRAM	DRAM	DRAM
●	○	○
BIOS and video	None	BIOS
Dell (32K)	Compaq (16K)	None
●	●	●
8MB	1MB	5MB
16MB	13MB	16MB
1 year on-site	1 year	1 year
B	B	B

ENDS

that it's difficult to pin down a standard one. For the CPU 286 machine with an Intel 80386 coprocessor, 512K expandable memory, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, the Standard Computer Corporation I/O card, an NCL 1:1 hard disk controller, and a clock/calendar with a Ray-O-Vac battery backup (no hard disk or video adapter), you'll pay \$1,295, plus an extra \$85 for DOS 3.3. For all of this plus 1MB of RAM, a 60MB Toshiba

hard disk, an RLL controller, a monochrome video card, and DOS, the price is upped to \$2,230; if you want VGA, the addition of a NEC 2A monitor and a Video Seven VGA card will bring the cost to \$2,980.

In addition to the Toshiba 40MB hard disk and RLL controller, our tested configuration included a Paradise VGA Plus 16-bit card and an Intel 80387SX math coprocessor, pushing the price up to



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Sunnyvale, CA 94089-7967  
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**PC**  
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**HEWLETT  
PACKARD**



The CPU 386/SX is a basic machine that offers solid performance and brand-name parts for a low price. Fully configured with 1MB of RAM, a 60MB hard disk, and a VGA monitor, this computer sells for \$2,980.

\$3,885—more in line with the competition.

Overall, the CPU is a respectable but not stellar performer, scoring consistently in the top half of the group on our benchmark tests. Its hard disk turned in impressive scores on the BIOS Disk Seek test and large-record DOS File Access test, faring well on the small-record test.

The CPU 386/SX is a solid and predictable whole made of brand-name, quality parts. If you're looking for a relatively fast, steady, and efficient machine to get the job done without fancy footwork, this one is well worth considering.

#### DELL COMPUTER CORP.

### Dell System 316

by Salvatore P. Ricciardi

When some of the best-engineered PCs are coming out of the land of the longhorn, it's not uncommon to hear someone recom-

mend buying your PC from a company in Texas. But with Dell Computer Corp.'s increasingly high-quality image, and with several *PC Magazine* Editor's Choice computers in Dell's product lineup, the word of the day seems to be getting more specific: Buy your machine from a company in Austin, Texas.

The Dell System 316 is a well-built, well-engineered addition to an already impressive lineup. Based on a 16-MHz 80386SX processor and housed in Dell's now-familiar AT-style cabinet, it's sure to give you cause to consider 386 technology. And at an entry-level price of \$2,999, you won't have to sell the house to place your bet.

The unit uses the Chips and Technologies NEAT chip set and the Phoenix Technologies 80386 ROM BIOS Plus. Both the system BIOS and video BIOS can be remapped from slow ROM into faster RAM memory for improved performance. The BIOS includes a resident setup program for configuring the machine.

System memory consists of 1MB of 80-

nanosecond DRAM in an interleaved page-mode configuration. The standard system comes configured with 256-kilobit SIMMs and is capable of supporting 8MB on the motherboard. You'll need to replace these SIMMs with 1-megabit SIMMs to get the full 8MB. You can add an additional 8MB using an expansion card, bringing maximum system memory to a total of 16MB. A 1MB upgrade using 256-kilobit SIMMs currently costs \$200; a 4MB upgrade using the more-expensive 1-megabit SIMMs costs \$2,200.

The motherboard holds 8 expansion slots, and it has one parallel port and two 9-pin serial ports standard. It can also accommodate an Intel 80387SX coprocessor. In our review unit, one 16-bit slot contained a Video Seven 16-bit VGA card. Two 8-bit slots and five 16-bit slots were still free, leaving plenty of room for expansion.

Support for peripheral storage is readily available. An internal drive bay can house one full-height hard disk or two half-height

#### PC FACT FILE

**Dell System 316**  
Dell Computer Corp., 9505 Arboretum Blvd.,  
Austin, TX 78759-7299; (800) 426-5150, (512)  
338-4400.

**List Price:** With 1MB RAM, 40MB hard disk,  
1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk  
drive, monochrome monitor, \$2,999; with DOS  
3.3, \$3,099; with VGA monitor, \$3,599; with  
100MB hard disk, \$4,299.

**In Short:** The Dell System 316 is a solid  
computer backed by a solid warranty. It has a  
reasonable price tag, comes with superb  
documentation, and gets high marks for  
expandability.

CIRCLE 547 ON READER SERVICE CARD

hard disks. Another bay on the right has space for three half-height devices visible through the front panel. Dell offers the unit with disk capacities of 40, 100, 150, and 322MB. The first two models use Conner Peripherals RLL drives, while the more-expensive units employ ESDI drives made by CDC and Metropolis. Our evaluation unit contained a 150MB Conner Peripherals drive, rated at 25 milliseconds, which performed right on target.

One of the unique aspects of the Dell System 316's design is its support for IDE (integrated drive electronics) hard disk drives. These drives, such as the Conner Peripherals drives used in the non-ESDI models of the System 316, contain all of the disk controller intelligence on-board.

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Bob Mealey

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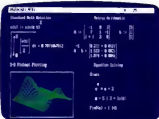


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The Dell System 316 boasts solid construction and more expansion options than most users will ever need. All this dependability comes at a fair price: \$3,599 for 1MB of RAM, a 40MB hard disk, and a VGA monitor.

Because of this design, you need not dedicate an expansion slot to a disk controller card unless you opt for one of the ESDI units.

The VGA Color Plus display monitor supplied with the System 316 provided excellent clarity and color. The keyboard, made by Key Tronic Corp., is of the 101-key variety and very comfortable to use.

Bundled with the System 316 are some useful utilities and diagnostic software. There's a set of VGA utilities, an excellent and colorful tutorial, and a system support diskette that includes diagnostic and disk setup functions. Dell's Enhanced DOS 3.3 (\$100) provides some additional features, such as a disk cache program and several disk management utilities.

Dell's documentation is well written and very well illustrated. It's clear, concise, and suitable to a broad audience of beginners and experts alike.

Optional software includes Dell Enhanced DOS 4.01 (\$120), Dell Enhanced OS/2 1.0 (\$325), and Dell Unix System V/386, Release 3.2 (\$995).

The System 316 was an average per-

former in PC Labs' benchmark tests. Particularly noteworthy were the scores for our tests of hard disk performance.

The Dell System 316 is an affordable high-quality entry point into 386 technology. With Dell's reputation and a 1-year warranty that includes on-site service provided by Xerox, it's well worth your consideration.

#### EVEREX COMPUTER SYSTEMS

### Everex Step 386is

by Catherine D. Miller

When you consider buying an Everex computer, remember that prices can be deceptive. At \$2,799 for the low-down basic configuration, Everex's Step 386is is one of the more-expensive 386SX computers reviewed in this roundup. But because Everex sells through dealers rather than directly, the list price is quite different from the selling price for the system. You may find that the actual street price will place

the Everex Step 386is among the less-expensive SX computers.

The Step 386is does give you a lot of machine for the money. It is based on Everex's Step 286 running at 16 MHz, and the two machines have much in common. Both are available in either a standard AT-size case, with access to five half-height drive bays, or a small-footprint case (6.4 by 17.1 by 16.5 inches, HWD), with two of the three half-height bays accessible from the front.

Our evaluation unit was housed in the small-footprint case. The front panel includes reset and turbo switches as well as turbo and microprocessor speed indicators. The sector of the hard drive currently being accessed is also displayed on the front panel. A smoked plastic cover slides over these indicators.

The Step 386is computer offers three microprocessor speeds—5, 8, and 16

**The manual  
accompanying the  
Everex Step 386is does  
a good job of covering  
all aspects of  
operation and clearly  
outlines the steps  
to be taken to upgrade  
the system.**

MHz—but only the 5-MHz and 16-MHz speeds can be selected using the turbo switch on the front of the machine. If you want to select 8 MHz you must use a software command.

The standard Enhanced-style 101-key keyboard shipped with all Everex computers is also included. The keys are set low but are adequately separated so as not to cause problems when you are typing. This lightweight keyboard has a nice clicky feel.

The parallels between the Step 286/16 and the Step 386is extend to the system board, designed by Everex. Both machines use identical motherboards. Two

## ONE ON THE WAY: Hewlett-Packard's HP Vectra QS/16S

**The Hewlett-Packard 386SX desktop machine is a small-footprint model for those who seek dependability from their PC vendor.**

by Salvatore P. Ricciardi

If you're a loyal customer of Hewlett-Packard, then you've often been well rewarded in the past. Following in that tradition, the new HP Vectra QS/16S just may be your dependable if unremarkable ticket into the 386 world. Because it's not currently available for purchase, we tested a version sent to us from across the Atlantic to give you an idea of what to expect.

The QS/16S is HP's entry-level 386 machine. With 1MB of RAM and a 1.2MB 5¼-inch floppy disk drive, the unit costs \$3,295. The first thing you'll notice is the machine's fairly small footprint and the familiar Vectra colors. The case is plain yet attractive, but the bright white on/off switch is likely to get your attention. It's made of plastic and looks out of place.

Once you open the case, you'll find the rest of the power switch, a long

plastic handle that leads into the power supply at the rear of the unit. At first glance you might think this is something used to keep things in place during shipping, but in truth it's the real power switch.

The rest of the machine sports a quality image and some interesting design techniques. The CPU and all system memory are on a board that plugs into a proprietary 32-bit slot in the motherboard. Sporting a 16-MHz Intel 80386SX microprocessor that is switchable to 8 MHz, it's compatible with all software that runs on a full-blown 80386DX. System memory consists of 100-nanosecond DRAM in an interleaved page-mode configuration. The standard machine comes with 1MB supplied as 256-kilobit SIMMs.

According to Hewlett-Packard engineers, putting the CPU on a card allows them to leverage the design of the rest of the unit. For example, the same motherboard design can be applied to a more capable machine using the 80386DX chip. All that's needed is a new CPU card design. In theory HP could offer CPU card upgrades this way, although none are planned at the moment.

The unit employs the Chips and Technologies VLSI circuit set and can accommodate an Intel 80387SX coprocessor. System memory is expandable to 8MB on the card using 1-megabit SIMMs. You'll have to replace the existing 256Kb SIMMs with the 1MB modules in order to get the full 8MB. You can add an additional 8MB using a daughtercard that attaches to the CPU



card. It, too, requires the 1Mb SIMMs to achieve the full complement of RAM. At press time, a 1MB upgrade kit cost \$650.

The QS/16S's AT-standard I/O bus resides on the motherboard and has plenty of room for expansion. It runs at 8MHz and provides one 8-bit slot and six 16-bit slots, one of which contains Western Digital Corp.'s ST-506 controller card. The card is capable of supporting two hard disks and two floppy disk drives, although the QS/16S's drive bay will accommodate only three half-height devices. The controller card includes one parallel port and one 9-pin serial port. A port for HP's proprietary HP-HIL (Human Interface Loop) is standard and is located on the rear of the unit, near the keyboard connector. You can purchase a mouse that uses this port from HP.

The review unit included a Seagate Technology ST-251 hard disk with an unformatted capacity of 40MB, a Paradise Systems VGA card, and an HP VGA monitor. The list price for this configuration, including DOS, is \$5,225. HP plans to offer higher-priced units later this year that employ larger hard disks, supporting capacities of ei-

banks of sockets can accept either 256-kilobit or 1-megabit DIPs for a total of 4MB RAM. Our evaluation unit came equipped with 2MB of 100-nanosecond DRAM in 1Mb DIPs. Although this board doesn't use a chip set, several VLSI chips are on the motherboard. In addition to the 32-MHz crystal necessary for a 16-MHz processor, a 30-MHz crystal is mounted on the motherboard. A Ray-O-Vac computer clock battery keeps the time.

Six 16-bit and two 8-bit slots sit to the

rear of the memory banks; a 200-watt Liton Electronic Co. power supply sits behind the drive bays. Everex's 8-bit Magic I/O serial and parallel adapter card provides the system with one serial and one parallel port. The card can support another serial port; serial port kits are available from Everex.

To bring 386 processing capabilities to the Step 386is, Everex has designed a daughtercard called In Step. The daughtercard is also available separately at a list

price of \$699, making it an easy matter for current owners of Everex Step 286s (whether 12- or 16-MHz units) to upgrade to 386 multitasking capabilities.

In Step plugs into the PGA (Pin Grid Array)-type 286 socket on Everex's 286 motherboard. (If you have an Everex Step 286 and are considering the In Step daughtercard, make sure the motherboard has the proper socket; older Step 286 models do not.) Surface-mounted on the top of this 2.5- by 5-inch card is the 80386SX

ther 108MB or 152MB with an ESDI controller.

The VGA monitor supplied with the test machine was of excellent quality. The Vectra keyboard, however, leaves much to be desired. It has a mushy feel and the thoroughly sculptured keys are difficult to get used to. I found myself making more than my usual share of typos using this keyboard. One nice feature is the ability to shut off the audible key click using either the keyboard or the system setup program.

HP includes a package of useful utility software with all models of the QS/16S. There's the HP's terminal emulation program, a disk cache program, a disk volume expansion utility for partitioning mass storage, and the HP expanded-memory manager for support of the LIM 4.0 EMS specification. Both DOS 3.3 (\$135) and OS/2 Version 1.0 (\$325) are optional.

The QS/16S proved to be an average performer in the PC Labs benchmark tests. It didn't lead the pack, but it didn't perform poorly either, and the use of HP's disk cache software may improve some of the numbers.

In general, the HP Vectra QS/16S is a solid machine, fitting in well with Hewlett-Packard's laid-back approach to PCs. But at \$5,225 for the tested configuration, you're paying more for the HP label than you may be prepared to. ■  
**HP Vectra QS/16S.** Hewlett-Packard Co., 974 E. Arques Ave., P.O. Box 486, Sunnyvale, CA 94086; (800) 752-0900, (408) 973-1919. **List Price:** With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$3,295; with 40MB hard disk, monochrome monitor, DOS 3.3, \$4,829; with VGA monitor, \$5,225.

CIRCLE 180 ON READER SERVICE CARD

and a socket for the 80387SX, which was included in our evaluation unit. The transition from a 286 motherboard to a 386SX is accomplished without sacrificing zero-wait-state performance.

Is there a performance penalty for this type of connection? Hardly. In all our memory and processor benchmark tests, the Step 386is performed close to the head of the class. Only ALR's 386SX offerings with the benefit of caching were able to beat out the Step 386is in processor tests.



The Everex Step 386is looks familiar because it's a Step 286/16 with a 386SX daughtercard. But don't scoff—it's a speed demon that outruns just about every other PC in this roundup. A monochrome system with 1MB of RAM and an 80MB hard disk costs \$3,827.



FACT FILE  
EDITOR'S CHOICE

**Everex Step 386is**  
Everex Computer Systems, 48431 Mimont Dr.,  
Freemont, CA 94538; (800) 356-4263, (415) 498-  
1111.

**List Price:** With 1MB RAM, 1.2MB 5¼-inch  
floppy disk drive, DOS 3.3, \$2,799; with 80MB  
hard disk, monochrome monitor, \$3,827; with  
EGA monitor, \$4,546; with 2MB RAM, 160MB  
hard disk, 80387SX coprocessor, \$6,393.

**In Short:** Consistently tops in performance, the  
Everex Step 386is is modeled on Everex's Step  
286/16 machine. By adding the In Step  
daughtercard to a completely unaltered Step  
286/16 motherboard, this machine offers the full  
benefits of the 386SX chip.

CIRCLE 148 ON READER SERVICE CARD

be the fastest in our large-record DOS File Access test and BIOS Disk Seek tests, and it placed second only to the NEC PowerMate SX in handling small records. A 1.2MB floppy disk drive from TEAC sits in the top drive bay.

The dark cloud in the performance of our Step 386is evaluation unit was the graphics. Everex doesn't offer VGA graphics, so the unit was shipped with Everex's Micro Enhancer Deluxe EGA card and Evervision EGA monitor. It's not surprising that this system was slow in PC Labs' video benchmark tests. We are somewhat surprised that it wasn't the slowest. After looking at all the VGA displays, we found it difficult to get excited about EGA.

The manual accompanying the Everex Step 386is does a good job of covering all aspects of operation and clearly outlines the steps to be taken to upgrade the system. It also includes a helpful glossary, table of contents, and index. If you're looking for fast 386SX performance, look at Everex. Although the list price may at first seem intimidating, persevere and your dealer may be able to offer the system at a fraction of the price.

This was the fastest machine we tested on our Conventional Memory benchmark test.

To speed things up even more, two utilities are included with the basic model: EDISK, which creates a RAMdisk, and QuickSTEP, a disk caching utility.

Our evaluation unit came equipped with a fast 160MB ESDI Wren hard disk and controller manufactured by Control Data Corp. The Wren hard disk proved to

MITSUBA CORP.

## Mitsuba 386SX Workstation

by Henry Fersko-Weiss

The Mitsuba 386SX Workstation is a computer with expansion stamped into its design. It has eight expansion slots, five drive bays, five cutouts in the back frame for serial and parallel ports, and a spacious interior to make adding boards a comfortable procedure. The computer is sturdy and well appointed in other ways as well.

On our benchmark tests the Mitsuba came out among the slower machines. The processor, which runs at a true 16 MHz, handled the processor tests fairly well, especially Floating-Point Calculation. The hard disk we tested ran at just under 28 milliseconds, and the memory operated at 72 ms. At a price of \$2,145 for the base configuration, or \$4,420 for a VGA system with 2MB RAM, a 71MB hard disk, and DOS included, it falls right in the middle of the cost curve.



Middle-of-the-road in both performance and price, the Mitsuba 386SX Workstation offers near-limitless expansion possibilities. For \$3,895, you'll get 1MB of RAM, a 71MB hard disk, and a VGA monitor.

### PC FACT FILE

**Mitsuba 386SX Workstation**  
Mitsuba Corp., 650 Terrace Dr., San Dimas, CA 91773; (714) 582-2895.  
**List Price:** With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$2,145; with 71MB hard disk, monochrome monitor, DOS 3.3, \$2,995; with VGA monitor, \$3,895; with 2MB RAM, \$4,420.  
**In Short:** The Mitsuba 386SX computer is extremely expandable. It has eight slots, one of which is a high-speed 16-bit slot, five drive bays, and cutouts in the rear panel enabling you to add ports without taking up slots. The computer's processor performance and its price both fall in the midrange.

CIRCLE 601 ON READER SERVICE CARD

We tested the \$4,420 configuration of the computer. It came with a board that provided a parallel port, a 9-pin serial port, a 15-pin game port, and a 25-pin serial port. These ports can be connected through the cutouts—two of which are for 9-pin and three for 25-pin connectors—so you don't have to use a second slot for the extra couple of ports. The 16-bit serial/parallel card, which is manufactured by Mitsuba, also has room for two more 9-pin ports and one 16-pin port.

Two other slots are occupied in this configuration; an 8-bit slot holds the Mitsuba VGA card and a 16-bit slot has the

Data Technology Corp. floppy/hard disk controller. So there are five open slots: one 8-bit, three 16-bit, and one high-speed 16-bit. The high-speed 16-bit slot is used for a memory expansion card that can have up to 8MB of memory. All these open slots make the Mitsuba a very expandable machine. There is room here for just about any set of peripherals you might ever want to add.

The five drive bays at the front end of the computer match its back-end expansion capabilities. Three of the bays are accessible through the front panel. This lets you have the ideal setup: both 1.2MB and 1.44MB floppy disk drives, as well as a streaming tape drive for backup. The two internal drive bays could house hard disks. Mitsuba offers three hard disk options in addition to the 71MB Micropolis drive we had in our tested configuration. The smallest is a Seagate 40MB drive, which, like the 71MB drive, uses an ST-506/412 MFM interface. The 150MB and 338MB Micropolis drives, which round out the hard disk options, both use the ESDI interface.

At the heart of the computer is the Mitsuba-manufactured motherboard. There are no odd jumpers on it; the circuitry looks clean and orderly. And there aren't any DIP switches to set. The motherboard can hold up to 2MB of RAM, which comes in two banks of 4-by-256-kilobit DIP chips. Another bank of 1-by-256-kilobit chips is used for parity. The memory uses page mode, and there is .7-wait-state operation. The 386 chip set comes from Chips and Technologies. An empty socket on the motherboard is ready for the 80387SX math coprocessor.

All the expansion capability of the Mitsuba 386SX translates into a fairly big chassis. The external measurements are 6.5 by 21 by 16.75 inches (HWD). This size makes the computer quite heavy—you definitely won't want to move it around much.

Mitsuba makes another chassis for its 386SX computer, called the Ultra Slimline Workstation. It is just as deep as the model we looked at, but it's only 14 inches wide and 2.5 inches high. To get this low, compact profile, Mitsuba cuts the slots down to

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five and turns them sideways so they are mounted horizontally.

The front panel of the model we tested has a vertical plastic strip in the middle that holds the reset and speed buttons as well as the lock. The on/off switch is on the side of the computer at the back end. The speed button looks as if it's very weakly attached and could break off easily. When you push it to the *out* position, it dangles slightly away from the panel. When you take off the outer shell to get inside the computer, you discover that the two buttons and the lock are on a plastic bridge that is screwed into place over the two drive bays. To get at the bays you first have to remove this plastic bridge. That and the fact that the connecting wires hang out over the front of the chassis make the arrangement awkward and a little more prone to trouble.

**At the heart of  
the computer is the  
Mitsuba-manufactured  
motherboard. There  
are no odd jumpers on  
it; the circuitry looks  
clean and orderly.**

The locking arm on the 1.2MB floppy disk drive also has a weak feel to it. When you close the drive, which comes from TEAC Corp., the arm doesn't move into place with a comforting click. Instead, it has a flat stop that makes me think you could easily move the arm past its intended position and snap it off. Since I didn't actually try this it may not be as weak as it seems.

The AT-style keyboard is manufactured by Honeywell. The keys have little spring to them. I find this unsatisfying because I moved from a manual typewriter to a computer. But I'm told that touch typists prefer the flatter feel. A DIP switch on the bottom of the keyboard lets you turn the clicking sound on or off.

The VGA monitor that came with our test configuration is manufactured by Mitsuba. The contrast, brightness, and on/off dials are well placed on the lower front surface of the monitor, but unfortunately the

available range of contrast is small.

Overall, the Mitsuba 386SX doesn't have many standout characteristics. It is passably fast, but it certainly won't shock anyone with its speed. Its price is on the low side, but again, not especially low. And it has some front-panel weaknesses. Yet the internal components are well laid out and seem well built. Most impressive of all is the expansion potential, a factor that may lure buyers in spite of the machine's failings.

NCR CORP.

## NCR PC916SX

by Henry Fersko-Weiss

The NCR PC916SX is an eccentric computer. Its processor and memory are on a plug-in card rather than the main motherboard, its video controller is piggybacked to the I/O controller, and it stands upright rather than lying flat on the desktop. It even comes standard with a 1.44MB 3½-inch floppy disk drive instead of the more typical 1.2MB 5¼-inch drive. The internal structure makes this computer easy to service and to upgrade. The external orientation suits its use in networks. Its price suits the well-to-do: at \$4,995 for the base model and \$5,694 for a VGA system, it's at the top of the 386SX price scale.

The more a computer costs, the better you expect its performance to be. Unfortunately, the NCR PC916SX doesn't follow this precept. To start with, its processor operated at 15.5 MHz rather than 16 MHz, which is the speed of the 386SX chip. Then it came in at the bottom of the pack on the 80386 Instruction Mix test; it was second-worst on Floating-Point Calculation.

The hard-disk performance of the computer was marred by the very slowest finish on the large-record DOS File Access test—although it did somewhat better on the small-record test and the BIOS Disk Seek. The video performance times were quite slow. On the Conventional Memory test, the computer was tied with several others in the third place from the bottom, while its Extended Memory test time was mediocre.

NCR justifies its high price with the quality of its manufacture and service. The machine is indeed well built. NCR manu-

factures its own motherboard—using the Intel 386 chip set—and its own hard disk controller—with a Western Digital chip set. NCR also manufactures its own VLSI chips, rather than going to a third party, and designs its own surface-mount technology. The chips used in the system are highly integrated—which cuts down on their number, resulting in a cooler system. None of the components the company buys are seconds.

NCR provides free on-site service during the 1-year warranty period. And there are service centers around the country for easy carry-in repair once the warranty has expired. Whether these factors balance out the weak benchmark test results and the high price is a tough call.

Standing upright, the NCR PC916SX measures 21.25 by 6.25 by 16.75 inches (HWD). With these dimensions it should sit comfortably beside your chair, under your desk and out of the way: it shouldn't crowd your leg room if you have a standard desk (a floor stand is available). The on/off switch is on the front panel, so you won't have any problem reaching it. The system lock and a volume control knob are



## FACT FILE

### NCR PC916SX

NCR Corp., 1700 South Patterson Blvd., Dayton, OH 45479; (513) 445-7478

**List Price:** With 1MB RAM, 44MB hard disk, 1.44MB 3½-inch floppy disk drive, DOS 3.3, \$4,995; with VGA monochrome monitor, \$5,250; with VGA monitor, \$5,694.

**In Short:** The NCR PC916SX is a floor-standing computer with a plug-in processor card and a piggyback VGA adapter. It's very well constructed, but its mediocre benchmark-test results make its stiff list price tough to stomach.

CIRCLE 602 ON READER SERVICE CARD

in a compartment on the front. The front panel is also used to vent the system.

From the front panel you can get at three of the five drive bays. The computer comes with a 1.44MB 3½-inch floppy disk drive and a 44MB hard disk from Rodine. The hard disk is in one of the internal drive bays, leaving the other two external bays available for a 1.2MB 5¼-inch floppy disk drive and a tape backup unit. NCR offers two other hard disk options: a 70MB ST-506/412 MFM drive from CDC and a 115MB ESDI drive from Maxtor. The front of the top two external drive bays is protected by a sliding plastic cover to keep dust and radiation down to a minimum.



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It may be beautifully constructed, but the NCR PC916SX's mediocre benchmark-test results and high list price detract from the computer's merits. This pricey model sells for \$5,694 with 1MB of RAM, a 44MB hard disk, and a VGA monitor.

The NCR PC916SX has eight expansion slots. Two of these are filled, one with the processor board and one with the I/O board. That leaves open two 8-bit slots and four 16-bit slots. None of the 16-bit slots are high-speed.

When you open the computer, you see one of the signs of NCR's attention to quality. On top of the drive bays are clips to hold the power cables and ground wires for extra drives. There's also a covered plastic container with compartments holding mounting rails and screws. The system battery is a 6V lithium battery, another sign of quality.

Because the processor for the computer is on an add-in card, NCR uses the same cabinet and backplane for its entire line of PCs, from an 80286 up to a full 32-bit 80386 computer. Thus, someone who bought a 286 PC could purchase the 386SX board and upgrade with a 15-minute installation process. People who buy the PC916SX can just as easily upgrade it to a full 386 machine.

The memory arrangement on the processor card is one row (but two banks) of 80-nanosecond 4-by-256-kilobit SIMM

chips. You can add 4MB of RAM to this board with a piggyback card. To reach 16MB of RAM, or more, you would have to add at least one or two expansion memory cards and take up slot space. The memory is dynamic RAM, with no scheme for making it work faster; the NCR computer is a one-wait-state machine. But the computer comes with disk cache software (*Smartcache*) that allows it to simulate the performance of a zero-wait-state machine for some of its operations.

The computer comes with a VGA controller as part of its standard configuration. The monitor, however, is extra. You can get a VGA monochrome monitor for \$255 or a VGA monitor for \$699. The screen on the VGA monitor we looked at measured 11.5 inches diagonally, which is smaller than the typical monitor screen. The monitor itself was smaller than most—it stood only 11.25 inches high, and it was lightweight. The on/off, brightness, and contrast controls are just behind the screen frame on the right side, which is less convenient than having them on the front.

The AT-style keyboard has a very nice feel to it. The keys have a good springy re-

sponse, and the clicking sound is pleasantly muted.

There is no question that the NCR PC916SX is a machine with quality manufacture and good features. You have to balance these pluses against its high cost, especially when you consider that the base model's many standard items prevent you from developing a moderate purchase strategy. When you add to this the computer's weak performance compared to other SX machines, you have to do some very careful thinking before you pull out your credit card.

#### NEC INFORMATION SYSTEMS INC.

### NEC PowerMate SX

by Henry Fersko-Weiss

The NEC PowerMate SX is a small-footprint computer with a somewhat unusual interior, interesting standard features, and good expansion facilities. But it's a costly implementation of SX technology with comparatively weak performance.

To begin, the computer operates at an average of 15.2 MHz, even though the 386SX processor runs at 16 MHz. Only one other SX computer in our review group, the NCR PC916SX, operated below 16 MHz—and it ran somewhat faster.

On our two processor benchmark tests the PowerMate SX came in close to the bottom. Its memory performance was even worse. On the Conventional Memory test it had the second-slowest average

#### The NEC PowerMate SX

is a costly

implementation of SX

technology.

read/write time, and its Extended Memory test time was the worst among all the computers. The PowerMate SX did better with the video tests, coming in somewhere in the middle of the pack. Its hard disk proved to be its best asset, scoring reasonably high on each test; it was the fastest of all on small records. But on the whole, the test results placed the PowerMate SX near the bottom of the pack.

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Landmark Software v. 1.1 benchmarks — a generalized index used to compare one machine to another. The higher the number, the better

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NEC eliminates two expansion slots and puts a drive bay on its side to narrow the footprint of its well-designed NEC PowerMate SX. Despite the solid construction, it's a poor performer that costs \$4,949 with 2MB of RAM, a 42MB hard disk, and a VGA monitor.



## FACT FILE

## NEC PowerMate SX

NEC Information Systems Inc., 1414 Massachusetts Ave., Boston, MA 01719; (508) 264-8000

List Price: With 2MB RAM, 1.2MB 5 $\frac{1}{4}$ -inch or 1.44MB 3 $\frac{1}{2}$ -inch floppy disk drive, DOS 3.3, Microsoft Windows/386, \$2,899; with 42MB hard disk, VGA monitor, \$4,949, 80387SX coprocessor, \$799.

In Short: The NEC PowerMate SX offers a lot of quality for a lot of money. Unfortunately, that quality extends to construction but not to performance, making the PowerMate SX a poor value.

CIRCLE 803 ON READER SERVICE CARD

which makes it one of the most expensive SX computers we reviewed.

The computer measures 6.3 by 16.5 by 16.5 inches (HWD) and sports an unusual interior. Partly because of its compact size, there are only three drive bays—all accessible from the front panel. One of them will accept only a 3 $\frac{1}{2}$ -inch drive format; it is positioned vertically alongside the other two bays, which take a 5 $\frac{1}{4}$ -inch format. The small bay can be used for a 1.44MB floppy disk drive or a 3 $\frac{1}{2}$ -inch hard disk. The model we tested had a 42MB hard disk in this bay. Because of the 3 $\frac{1}{2}$ -inch drive's position and smaller size, it's easy for you to get at the ribbon and power cables that link it to the Western Digital controller.

On the other side of the 5 $\frac{1}{4}$ -inch drive bays is a small board bolted to a metal bridge coming off the top frame of the bays. This little board holds the 80386SX chip and has a socket for the 80387SX math coprocessor.

To the side of the drive bays are the

LED lights. In addition to the power and hard disk lights, there is a light indicating when the machine is operating at 16 MHz. The on/off switch is on the right side toward the rear.

There are six slots in the computer: four regular 16-bit slots, one proprietary high-speed 16-bit slot, and one 8-bit slot. The high-speed slot is dedicated to an expansion board that can hold up to 10MB of high-speed memory. The system can have a total of 16MB of RAM. The 2MB of memory on the motherboard comes in 80-nanosecond 1-megabit SIMM chips. The memory scheme is four-way interleaving; the computer operates at 0.6 wait states. You can designate up to 1MB of memory for disk caching through *Microsoft Windows/386*, which helps with the operational efficiency of the system.

The motherboard for the computer is manufactured by NEC and has VLSI chips on it, also manufactured by NEC. This control over the heart of the computer lets NEC maintain a high standard of quality. In addition to the PowerMate SX, NEC produces a PowerMate Portable SX with a gas plasma display (see the sidebar "386SX Power that Comes in a Lunch-box").

The AT-style keyboard is just slightly bigger than similar keyboards; it's 19 inches wide and 8.5 inches deep. The keys have a nice spring to them, as does the Spacebar, and the clicking sound is neither too loud nor too muted.

NEC offers two monitors. The VGA monitor we received with our test system, the MultiSync II, has a screen that measures 13.25 inches on the diagonal. It's capable of an 800 by 560 resolution. The monitor's on/off switch and brightness and contrast controls are on the front, just under the screen frame. I found the range of the brightness control somewhat limited. Alongside these controls is a pull-down door revealing vertical and horizontal controls as well as switches for the text color—you can choose white, amber, or green. The other monitor choice is the MultiSync XL, which has a 20-inch screen and goes up to a 1,024 by 768 resolution.

The PowerMate SX is a high-quality computer with welcome expansion facilities, and it comes with DOS 3.3 and *Windows/386* as part of the standard configuration. These characteristics would be enticing if the price were lower or the performance much better. But as things are, this SX computer seems overpriced for what it delivers.

A standard configuration comes with 2MB of RAM, an ST-506/412 MFM floppy/hard disk controller, a serial and a parallel port, DOS 3.3, GW BASIC 3.2, and *Microsoft Windows/386*. This combination costs \$2,899. When you add in a NEC 42MB hard disk and a VGA card and monitor, the system ends up costing \$4,949,



## 386SX POWER THAT COMES IN A LUNCHBOX

Not all the new  
386SX computers  
are bound to your  
desktop. If you're  
looking for a  
luggable, NEC has  
the only entry  
currently on the market.

by John Dickinson

NEC's new 80386SX-powered PowerMate Portable SX inspires ambivalence. It's neither 386 fish nor 286 fowl in the PC performance arena. And, like all AC-only lunchpail-style portables, it isn't really a desktop PC, and it isn't so portable that you can use it in an airplane or on your lap in a park. Its \$6,595 price puts it squarely between 286- and 386-powered transportable PCs. See what I mean? The PowerMate Portable SX may be the first entry in an entirely new class of PC, 386SX portables, but it's hard to know whether to laud it or pair it.

Nevertheless, it's an interesting transportable PC because it's powered by Intel's 16-/32-bit 80386SX chip—the central point of this roundup—and because that orange-colored, low-contrast, gas-plasma display is driven by a Paradise Systems VGA chip, which yields crisp, high-resolution graphics. It even has decent gray scaling for a plasma display. The combination makes *Microsoft Windows/386* a smooth, reasonably affordable portable multitasking graphics system, and the PowerMate Portable SX will do well with OS/2 and Presentation Manager when NEC gets around to shipping Release 1.1.

The performance statistics are not at

all startling and lie squarely between 12-MHz 286-powered portables and their full-blown, 20-MHz, 386-powered brethren. For example, the NEC buzzes through the PC Labs 80286 Instruction Mix benchmark test in 5.0 seconds, while Compaq's 286-powered Portable III takes 6.04 seconds and the Portable 386 3.29 seconds. Other statistics read about the same, although the gas-plasma VGA screen is faster than the competition, as is the 42MB 24-millisecond hard disk.

Luggability is not great. Weighing in at a healthy 21 1/4 pounds, the PowerMate SX's saving grace is a huge, well-designed, and padded handle that makes it easy to pick up and carry. Unfortunately, the handle doesn't make the Portable SX any lighter. Nor does the optional oversized, overweight, padded case, which is only handy if you're planning on being in the rain a lot or want to carry lots of manuals and accessories, such as mice or hand scanners.

On the other hand, the PowerMate SX keyboard folds nicely in and over the screen for carrying, and the coiled cord lets you position it to your liking. At 12 by 16 by 8 inches (HWD), this unit is not as small as Compaq Computer Corp. or Dolch Computer Systems transportables, but the PowerMate SX is easy to handle, and the tiltable screen is nearly full-sized (at 10 1/2 inches diagonal) and has a normal aspect ratio.

The new NEC also has three full-length 16-bit slots that are easy to reach through a hatch in the top of the unit's cabinet. Three is plenty for this transportable, because it comes with a serial port, a parallel port, and the VGA system already on the motherboard. Installing options is a snap, and it took less time to install Logitech's new bus mouse than it would in any desktop PC.

Also on the motherboard is a standard 2MB of 80-nanosecond RAM. The RAM is on its own bus and can be supplemented by NEC-manufactured daughterboards in 2MB increments for a total of up to 10MB. Prices for the extra memory start at \$1,495 for the 2MB



daughterboard. The least-expensive 10MB configuration requires a 4MB daughterboard and a 4MB attachment board for a total cost of \$5,790. Other NEC-supplied options include an 80387SX math coprocessor and a 1,200-bit-per-second internal modem card.

You can attach any VGA or compatible multisync monitor to a standard analog connector if you plan to use the PowerMate SX at your home base for a while. While you're home, you can also attach a standard 101-key keyboard and type with a bit more comfort than the rattly NEC-supplied portable keyboard affords.

So what's the point of the PowerMate Portable SX? It gives you portable 386 power at a price right between 286-powered and full-scale 386-powered portables. In other words, its function in the luggable PC market parallels its function in the desktop 386SX market. We're still waiting for the first battery-operated SX laptop to prove the point of the 386SX's low-power, compact-sized CMOS flat-pack technology. But in the meantime, the PowerMate Portable SX will give you well-built, 386SX-powered luggable computing. ■

John Dickinson is PC Magazine's executive editor of West Coast operations.



## FACT FILE

**NEC PowerMate Portable SX, NEC**  
Information Systems Inc., 1414  
Massachusetts Ave., Boston, MA  
01719-9988; (508) 264-6000. **List Price:**  
With 2MB RAM, 42MB hard disk, \$6,595.  
2MB RAM upgrade, \$1,495; 80387SX  
coprocessor, \$799; 1,200-bit-per-second  
internal modem, \$395.

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## SPEAR TECHNOLOGY INC.

**Spear 386/16SX**

by Henry Fersko-Weiss

The Spear 386/16SX computer comes in just about any configuration you could ask for, at a price that makes it one of the best buys around. The standard, stripped-down configuration is only \$1,659, and with VGA graphics and a 44MB hard disk it costs only \$2,899. Add to this the good processor performance, plus on-site service for only \$45, and you have a very attractive system.

The Spear's case is somewhat smaller than a traditional IBM AT. It measures only 6.25 by 17 by 16.5 inches (HWD). The front panel allows access to two of the three half-height drive bays, all stacked on the right side. You can get a large-chassis model of the computer—for \$30 more—with five drive bays. That model plumps out to 21.2 inches wide and stands almost half an inch taller than the standard version. Right next to the drive bays on the front is a pull-down door that protects the reset and speaker on/off buttons. Having the reset button in a covered compartment is a good idea—you can't hit it by accident. On the other side of this compartment is the lock and the LED lights. The bottom of the panel is used to vent the system's innards.

There isn't much excess room inside the Spear because of its compact design. The ribbon cables connecting the hard and floppy disk drives to the controller are stuffed in between the drive bays and the 200-watt power supply. In the model we tested, the controller, from Scientific Micro Systems, used an ST-506/412 MFM interface. The hard disk was from Toshiba and formatted to 44.7MB with a 23-millisecond random access time. The hard disk choices are hardly limiting; they range from 20MB all the way up to a 600MB ESDI drive. The hard disk we tested cost \$470, while a 160MB Micropolis costs \$1,667 with the controller and the 600MB Maxtor costs \$3,600 with the controller.

The basic configuration for the Spear doesn't include a hard disk, although it does include an MFM floppy/hard disk controller with 1:1 interleave. Also absent are a video controller and a monitor. For the \$1,659 you get 1MB of RAM, a 1.2MB 5¼-inch floppy disk drive, a serial and a parallel port, an Enhanced-style keyboard, and a clock/calendar. The proces-



One of the better values in this roundup, the Spear 386/16SX sells for just \$2,899 with 1MB of RAM, a 44MB hard disk, and a VGA monitor. Spear offers a nearly unlimited number of configurations for this solid performer.

sor runs at 16 MHz or 8 MHz, controlled by pressing Ctrl-Alt along with either the numeric Plus or Minus key. The keyboard has a somewhat flat, unresponsive feel; it makes very little sound when you type.

The Spear comes with eight expansion slots. Two are 8-bit, four are 16-bit, and two are high-speed, proprietary 16-bit slots. The high-speed slots can be used for 8MB memory expansion cards that will bring the total memory of the system up to 18MB including the 2MB of RAM on the motherboard. Since the high-speed memory cards run at 16 MHz like the processor, they have zero wait states. The motherboard RAM is arranged in two banks of 4-by-256-kilobit DIP chips that run at 80 nanoseconds with zero wait states as well. Another bank of 1-by-256-kilobit chips are there for parity. The Spear uses a page-mode memory scheme.

The motherboard used by Spear is a proprietary design by Everex. It uses one VLSI for the basic system logic. The 80386SX processor is a square chip about the size of a thumbnail. The rest of the

## PC FACT FILE

**Spear 386-16SX**

Spear Technology Inc., 710A Landwehr Rd., Northbrook, IL 60062; (312) 480-7300.  
**List Price:** With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$1,659; with 44MB hard disk, monochrome monitor, DOS 3.3, \$2,343; with VGA monitor, \$2,899.  
**In Short:** The Spear 386-16SX is very competitively priced and comes configured just about any way you want, with hard disk options up to 600MB. It's highly expandable and sports better-than-average processor performance. An overall smart buy.

CIRCLE 804 ON READER SERVICE CARD

board is populated with discrete logic chips, not too spread out because of the smaller footprint of the machine. A socket for the 80387SX math coprocessor resides in the middle of the board next to the processor.

Graphics is another matter of choice for the buyer. You can get a monochrome monitor for \$79 or just about any other



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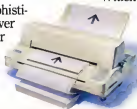
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## WHAT'S NEW IN PC LABS BENCHMARK SERIES, RELEASE 5.0

The newest version of our industry-standard PC Labs Benchmark Tests offers an SAA-like interface and graphs galore.

by Salvatore P. Ricciardi

We're not content to rest on our laurels. That's why we're pleased to announce the newest release of PC Labs' industry-standard benchmark tests. PC Labs Benchmark Series, Release 5.0, incorporates more new features than any previous release.

The first thing you'll notice is our all-new SAA-like user interface, modeled after IBM's Systems Application Architecture. We've incorporated many of the features made familiar by *Microsoft Windows*, the OS/2 Presentation Manager, and applications such as *Microsoft Works*. For example, you can activate menu choices by selecting from pull-down menus using either the keyboard or a mouse. And you can choose your benchmark tests from dialog boxes employing checklists and push-buttons.

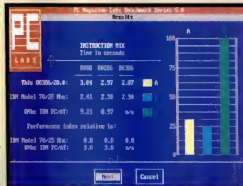
Next, you'll find that in Release 5.0 all of the benchmark tests compare the results for the machine being tested with those of two other standard machines. And we've increased our use of bar charts to enhance the presentation. Whereas previously only the processor tests were graphed, Release 5.0 uses bar charts for nearly all of the test results.

The machines used for comparison are still chosen automatically, but in keeping with advances in the state of the art, we've chosen a different high-end machine against which to compare. If the processor of the machine being tested is an Intel 80386, the standard comparison machines are now the 25-MHz IBM PS/2 Model 70-A21 and the 8-MHz IBM AT. Otherwise the standard comparison machines are the 8-MHz IBM AT and the 4.77-MHz IBM XT.

With Release 5.0 you can save your PC's test results to a disk file. And a simple menu choice lets you enter a short description of the machine being



PC Labs Benchmark Series, Release 5.0, has an SAA-type user interface that provides pull-down menus and pop-up dialog boxes for test selections.



Results are displayed in an expanded numerical format with larger our graphs. Graphed comparisons against standard machines are now displayed for all benchmark tests.

tested. The file written is an ASCII file, so you can use many other programs to analyze the results.

### CONTINUITY OF RESULTS

Because of some changes we've made to enhance the benchmark tests, the results obtained from this release should not be compared with those obtained from former releases. We've tightened up the code in some places, shifted it about in others, and made efforts to improve the tests' reliability. In some instances, advances in compiler technology have resulted in improved tests—and new numbers.

For example, you'll notice that the

Floating-Point Calculation results are faster with Release 5.0. But for the most part—and especially with the tests of processor performance, which are the core of our benchmark test series—the differences are minor. A fast machine in previous releases remains a fast machine in 5.0.

Some of our old tests haven't made the cut to our new look. For instance, our VGA hardware compatibility test and our EGA/VGA quality test were not converted in time for Release 5.0; they continue to sport their old familiar Spartan look. You can look forward to a fresh face on both of these in an upcoming release.

### YOURS FOR THE ASKING

There are two avenues to follow if you'd like to obtain a copy of the new benchmark tests on-disk. Through the mail, send your name, title, company, address, and phone to *PC Magazine*, PC Labs Benchmark Test Registration, One Park Ave., New York, NY 10016.

To access the tests on PC MagNet, type GO UTILFO <Enter>, LIB3 <Enter>, BRO BENCH5.EXE <Enter>, and you will see a description of the file. At the end of the file description, you'll see the prompt "Disposition," to which you reply DOW <Enter> to download the file. While in Lib 3 you can access a short documentation file, BENCH5.DOC. Type BRO BENCH5.DOC <Enter> to read a description of the file, and DOW <Enter> at the "Disposition" prompt to download it.

Release 5.0 represents a major effort on our part to upgrade our technology. As always, we're responding to change. And we're already planning new releases and enhancements—a furthering of our commitment to finding out which machines are the market's stars. Look for them in the months to come.



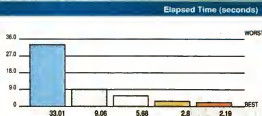
## BENCHMARK TESTS: STANDARD BENCHMARK MACHINES

True, results achieved with PC Labs Benchmark Series Release 5.0 are no longer directly comparable to results from Release 4.2. But both versions tell the same relative story of how tested

products perform in relation to benchmark machines. To help reestablish the comparative framework, here's a sampling of how landmark machines fare when tested with the new benchmark tests.

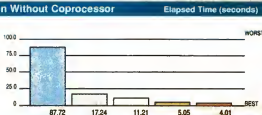
### Instruction Mix

The Instruction Mix benchmark test times a series of tasks specific to the 8086, 80286, or 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



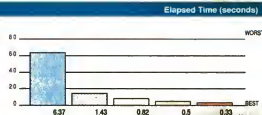
### Floating-Point Calculation Without Coprocessor

The Floating-Point Calculation Without Coprocessor benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



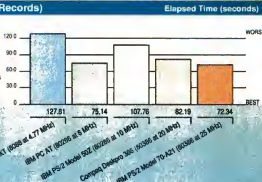
### Conventional Memory

The Conventional Memory benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



### DOS File Access (Small Records)

The DOS File Access (Small Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.







# BENCHMARK TESTS: STANDARD BENCHMARK MACHINES

## DOS File Access (Large Records)

Elapsed Time (seconds)

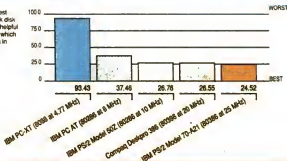
The DOS File Access (Large Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



## BIOS Disk Seek

Elapsed Time (milliseconds)

The BIOS Disk Seek benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.

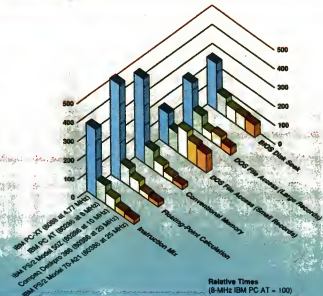


# BENCHMARK TESTS: COMPOSITE VIEW

The numbers may be slightly different, but the story remains the same for this selection of previously reviewed computers, tested here under Release 5.0 of the PC Labs Benchmark Series. Speed is the ultimate goal for the jumps from 4.77 MHz to 25 MHz (and beyond), but increases in computing speed are not linear across all segments of the tests.

IBM has accelerated the instruction mix times from a crawl at 33.01 seconds on a PC-XT, to faster than a speeding bullet at 2.19 seconds on its latest 25-MHz PS/2 Model 70-A21. However, the data throughput rates exemplified in the large and small-record results indicate that despite more-than-modest increases in the physical speed of hard disk seek times, data transfer speed simply hasn't kept up. Partially due to the physical limitations of current hard disk technology, much of the blame for lagging data can be pinned on the old AT bus architecture, which is jammed at 8 MHz for compatibility with older boards and software.

Micro Channel architecture may or may not be the ultimate solution, but moving large quantities of data is certainly faster for the IBM Models 502 and A21 without the impediment of compatibility. The crucial point from the perspective of an improved testing suite is that the newest version of our benchmark tests communicates this unfolding story of a maturing computer technology with ever-greater clarity and pinpoint accuracy.





# BENCHMARK TESTS: 80386SX-BASED COMPUTERS

When ranked against a sampling of 16-MHz 80286 and 80386 computers, 386SX PCs form a cluster that fills in the gap between 286 and 386 performance. Only the Everex

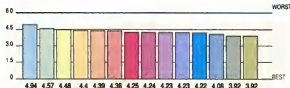
Step 386i and ALR's VIP SX386 and FlexCache SX386Z perform right along with the 16-MHz 386s against which they should be competing.

## PROCESSOR AND MEMORY BENCHMARK TESTS

### 80386 Instruction Mix

Elapsed Time (seconds)

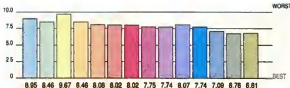
The 80386 Instruction Mix benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



### Floating-Point Calculation Without Coprocessor

Elapsed Time (seconds)

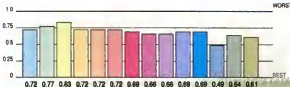
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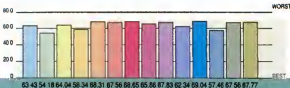


## DISK BENCHMARK TESTS

### DOS File Access (Small Records)

Elapsed Time (seconds)

The DOS File Access (Small Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



NEC PDP16SX  
NEC PowerMate SX  
Compaq Deskpro 386S  
Dell System 316  
Seam 386SX  
Twinhead Superior 490  
Mitsumi 386SX Workstation  
CPU 386SX  
Clio AT Model 316SX  
Zeebe 386-16SX  
Seam 386/16SX  
Everex Step 386i  
ALR FlexCache SX386Z  
ALR VIP SX386



## The Persistence Of Time.

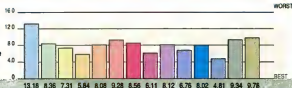


## BENCHMARK TESTS: 80386SX-BASED COMPUTERS

## DOS File Access (Large Records)

Elapsed Time (seconds)

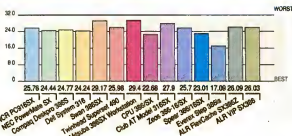
The DOS File Access (Large Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



## BIOS Disk Seek

Elapsed Time (milliseconds)

The BIOS Disk Seek benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.

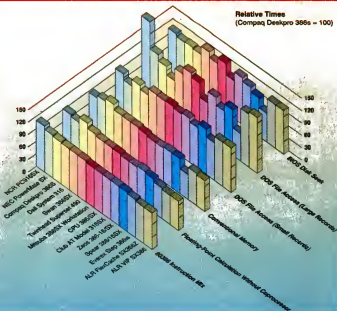


## PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

Relative Times  
(Compaq Deskpro 386S = 100)

Although technologically superior to their 80286 ancestors, the first crop of 80386SX machines hardly performed with the gusto of their 16-MHz 80386 counterparts. Only the Everex Step 386S and the two offerings from ALR—the breadbox ALR VIP SX386 and the ALR FlexCache SX386Z—managed to invade 80386 territory, with numbers that would have placed them among the top half of the 16-MHz 80386 computers PC Labs tested for our 386 blockbuster issue (May 30, 1989).

The bulk of the 386SX machines fell squarely between 286 and 386 ratings; the only straggler was the NCR PC916SX, which dropped well back into the realm of 16-MHz 80286 performance levels. Although 386SX machines have been touted as providing 386 performance at 286 prices, currently price and performance alike have been failing between these two standards.



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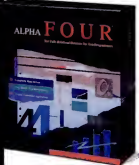
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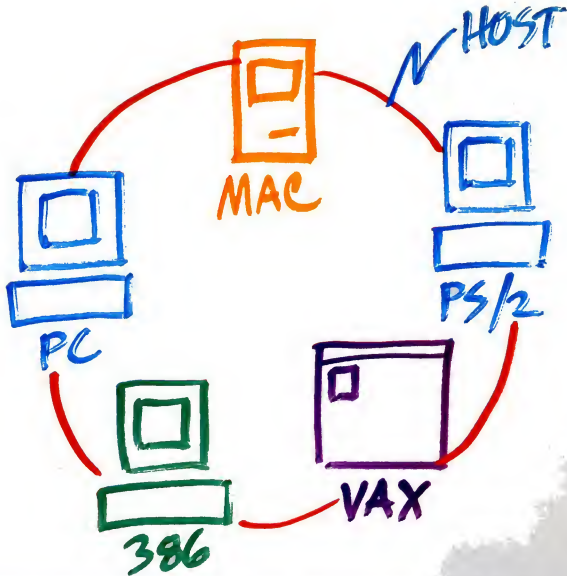
While this variety of solutions makes it easy for users to meet their needs, it presents some problems. Like sharing information between incompatible systems. The kinds of problems facing more and more companies as their information systems grow and diversify.

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**The power to choose.** With NetWare, Novell gives you the most powerful combination of network performance, security,



## and you can choose all of these.

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And as your computing needs expand, the network will grow with you. Giving greater networking capability and allowing you to connect to new environments.

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Gold Novell Authorized Reseller, or call 1-800-LANKIND.



For network solutions,  
you should be seeing red.





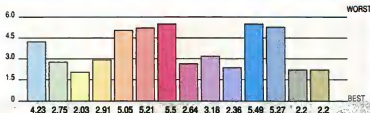
# BENCHMARK TESTS: 80386SX-BASED COMPUTERS

## VIDEO BENCHMARK TESTS

### Direct to Screen

Elapsed Time (seconds)

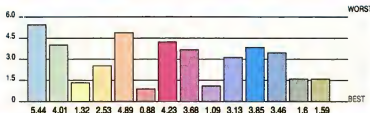
The Direct to Screen benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



### Video BIOS Routine Without Scrolling

Elapsed Time (seconds)

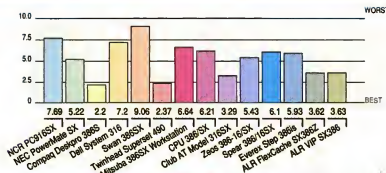
The Video BIOS Routine Without Scrolling benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



### Video BIOS Routine with Scrolling

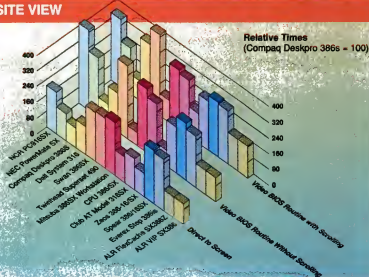
Elapsed Time (seconds)

The Video BIOS Routine with Scrolling benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



## VIDEO BENCHMARK TESTS: COMPOSITE VIEW

As always, video timings are relative to the type of video board submitted with each machine tested. Typically, 16-bit VGA boards will perform faster than 8-bit boards. The Everex Step 386S was the only machine we received with an EGA card; all the others contained VGA boards. EGA results appear slightly faster than the corresponding 8-bit VGA numbers because of the simpler operations involved in the lower-resolution EGA environment.



# You thought you'd have it made in the shade when you bought into the 386SX™



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### You Get More With Harris' 80C286.



When you're looking for extra performance, ask for systems designed around our 80C286.

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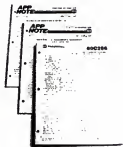
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OS/2 lets you take full advantage of Micro Channel.™

OS/2 provides an optional Communications Manager which allows easy networking.

OS/2 lets you keep two or more programs running at the same time, so you can do more.

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kind of monitor up to VGA. The system we tested had a Tatung CM-1496 VGA monitor that goes for \$428. Its resolution is 640 by 480, and amber, green, white-on-blue, or white-on-black text can be selected from the front. The contrast and brightness controls have a wide range of response. Unfortunately, they are not on the front of the monitor—you have to reach around to the left side toward the top. The on/off switch is on the other side in about the same position.

The VGA card in our test model was an ATI Elan Plus 8-bit adapter with 512K of video memory; it cost \$270. It came in very slow on our benchmark tests: Direct to Screen access took 5.49 seconds, for example. But Spear also carries the much faster Paradise 16-bit VGA card for \$367.

The Spear SX computer has a typical 1-year warranty. Fulfillment of this warranty can be through the mail, or by on-site service from National Computer Services, at a cost of \$45 for the whole year. The convenience of this service is well worth the minimal fee.

In addition to the options already mentioned, Spear sells OS/2 or DOS, a number of tape backup units (as high as 125MB), modems, a 150-watt power supply, disk cache software, and more. With this wide selection of options, there is no such thing as a standard configuration—you can customize the computer to suit your needs. Given the excellent prices Spear offers, and the respectable performance of the processor, there are quite a few reasons to take a good look at this system.

#### TUSSEY COMPUTER PRODUCTS LTD.

### Swan 386SX

by Catherine D. Miller

On the surface, Tussey's Swan 386SX appears more like an ugly duckling than a swan. Its cheap XT look and size—6.5 by 21 by 16.5 inches (HWD)—makes it a rather ungainly addition to an already cluttered desk. But at \$2,349 for a monochrome system including an 80MB hard disk and DOS 3.3, the Swan 386SX starts to look more attractive. It's one of the lowest-priced computers reviewed in this roundup.

The front panel is adorned with a reset switch and power, disk, and turbo lights. The power switch is located on the right



Tussey's Swan 386SX doesn't offer lightning speed or dazzling innovation, but it's inexpensive and highly expandable. The price is just \$2,948 with 1MB of RAM, an 80MB hard disk, and a VGA monitor.

side in the rear. The Swan 386SX's XT/AT switchable keyboard has a pleasant clicky feel, with low keys that aren't too close together.

The inside of the Swan 386SX is roomy and for the most part nondescript. Three of its five 5¼-inch half-height drive bays are accessible from the front of the machine, with the power supply directly behind. Two 8-bit and six 16-bit slots line up along the rear of the machine. Next to the 200-watt Austec power supply are five cutouts (three 25-pin and two 9-pin) for the extra serial and parallel ports available on the 8-bit Swan AT Multi I/O card without blocking a slot. The printer/port card, which includes one parallel, one serial, and one game port, is included in the basic \$1,499 configuration.

The Swan 386SX's 16-bit Adaptec MFM controller card handles two floppy and two hard disk drives. A 1.2MB floppy disk drive from TEAC is included as standard fare. The \$2,937 machine we tested was equipped with a 80MB hard disk from Magnetic Peripherals. This drive's performance in PC Labs' benchmark tests

was unremarkable at best. The Swan was one of the slowest machines tested with small records and was slightly above average in handling large records.

The Swan's performance on our microprocessor and memory benchmarks was also disappointing. It consistently placed in the lower third of the machines tested.

The Key Tronic system board makes use of the Chips and Technologies 386SX



#### FACT FILE

##### Swan 386SX

Tussey Computer Products Ltd., 3075 Research Dr., State College, PA 16801; (800) 466-9044, (814) 234-2236.

List Price: With 1MB RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, \$1,499; with 80MB hard disk, monochrome monitor, DOS 3.3, \$2,349; with VGA monitor, \$2,848; with 2MB RAM, \$2,937.

In Short: The Swan 386SX is one of the largest, slowest, and cheapest machines reviewed in this 386SX roundup. An excellent manual, helpful to new PC users as well as the more experienced, is the most attractive piece of this package.

CIRCLE 608 ON READER SERVICE CARD

## THE BENCHMARK-TEST DEVELOPMENT PROCESS

Release 5.0 of the PC  
Labs Benchmark  
Series wasn't  
created out of thin  
air. It took some of  
the market's top  
software programs to  
bring it into existence.

by Salvatore P. Ricciardi

Anyone who has developed a software product on a strict schedule knows that it's a challenge. It requires careful planning, a logical approach, and the right tools. Here at PC Labs we use the same tools that you do. In fact, in developing our latest release of the PC Labs Benchmark Series we relied on a number of products to help us get the job done accurately and on time.

For example, during the design process we used the program *Dan Bricklin's Demo II* to prototype the look and feel of the benchmark tests. We then gathered valuable feedback from the Labs and editorial staff based on this prototype. This process led to design decisions and changes, which we later incorporated into the final version. Thus we prevent having costly delays

caused by an ever-changing spec.

During development we came to rely upon a number of products. For instance, *Source Print*, from Powerline Software, helped us produce neatly indented and cross-referenced listings of our C language source code. Such listings are useful for following the flow of a program, and they helped us spot structural errors.

IQ Engineering's excellent Super Cartridge I let us print source code listings at 149 lines per page on our HP LaserJet Series II printers using a very readable 5-point line-printer font. This cartridge helped us save a great deal of paper; better still, we were able to see much more at a glance than before.

We used The Periscope Company's *Periscope I* debugger to nail down tough assembler bugs, while *C-scape*, a product of the Oakland Group, provided us with a foundation for our new user interface.

Borland International's *Turbo Debugger* and language products enabled us to get our programs up and running quickly. *Turbo Debugger's* use of the 80386 virtual mode allowed us to run our benchmark tests in situations that would otherwise have been difficult, and its superior user interface helped us find the fast path to an answer without having to study cryptic commands.

This all goes to show that we don't just write about the tools of the trade—we actually use them. Indeed, the latest release of the PC Labs Benchmark Series, Release 5.0, would not have been possible without this group of some of the industry's best tools. ■

NEATSX chip set and 386 NEAT BIOS. Running at 16 MHz with zero wait states, the microprocessor speed is software-switchable down to 8 MHz. Bus speed tested out at 8 MHz at both microprocessor speeds.

Sockets for SIMMs are inconveniently located under the lower left drive bay. If you do have a drive in this bay, as our tested model did, you'll have to take it out to increase your system's RAM. The system we reviewed included 2MB of 100-nanosecond RAM in eight 256-kilobit SIMM

packages. The sockets also accept 1-megabit SIMMs, bringing the total RAM on the motherboard up to 8MB.

The SETUP utility has a handy feature allowing you to set up memory over 1MB as either extended memory, LIM EMS 4.0, or a combination, making it easy to use the expanded memory capabilities of software packages such as *WordPerfect* or multitasking environments such as *Microsoft Windows/386* and *DESQview*.

Our review unit included a NEC II monitor and Swan's 8-bit VGA card.



## FACT FILE

**C-scape, Version 3.0**  
Oakland Group Inc., 675 Massachusetts Ave., Cambridge, MA 02138; (800) 253-2733; (617) 491-7311.  
List Price: \$399 (DOS version).

CIRCLE 606 ON READER SERVICE CARD

**Periscope I**  
The Periscope Company Inc., 1197 Peachtree St., Plaza Level, Atlanta, GA 30361; (800) 722-7006, (404) 875-8080.  
List Price: \$695.

CIRCLE 609 ON READER SERVICE CARD

**Source Print**  
Powerline Software Inc., 2531 Baker St., San Francisco, CA 94123; (415) 346-8325.  
List Price: \$97.

CIRCLE 610 ON READER SERVICE CARD

**Super Cartridge I**  
IQ Engineering, Box 60955, Sunnyvale, CA 94086; (408) 734-1161.  
List Price: \$499.

CIRCLE 611 ON READER SERVICE CARD

**Dan Bricklin's Demo II**  
Peter Norton Computing, 100 Wilshire Blvd., #900, Santa Monica, CA 90401; (213) 319-2000.  
List Price: \$195.

CIRCLE 612 ON READER SERVICE CARD

**Turbo Assembler/Turbo Debugger**  
Borland International, 1800 Green Hills Pk., Scotts Valley, CA 95056; (408) 436-8400.  
List Price: \$149.

CIRCLE 613 ON READER SERVICE CARD

Based on Cirrus Logic's VGA controller chip, this card includes an autosenosing feature that automatically configures itself for an 8- or 16-bit slot. Although the unit was shipped with the VGA card in an 8-bit slot, we tried putting the card in a 16-bit slot. Its performance on our video benchmark tests was unchanged. The Swan 386SX turned in disappointing performances in our three video benchmark tests—among the slowest machines on each test.

In addition to displaying 16 colors at the

CONTINUES

# ZEOS®

MAGAZINE  
EDITOR'S  
CHOICE  
2-26-89

MAGAZINE  
EDITOR'S  
CHOICE  
5-30-89

MAGAZINE  
EDITOR'S  
CHOICE  
5-30-89

**“Out of 104 machines from 58 companies... for overall excellence in both the 16- and 20MHz categories, we selected ZEOS International's 386-16 and 386-20”**

*PC Magazine, May 30, 1989*

**“For Overall Excellence...”**

*PC Magazine, May 30, 1989*

PC Magazine recently reviewed and rated 104 '386 systems from 58 companies.

The competition was tough. The giants were everywhere. IBM, Compaq plus Hewlett Packard, AT&T, Tandy, NEC and more. It was the biggest product review ever undertaken in our industry. Virtually every system in production was tested. And who was the best?

Out of all systems. Out of all companies. *Only one was chosen For Overall Excellence.* The one selected? ZEOS International.

ZEOS means “Overall Excellence” for PC Magazine and virtually every other major computer publication too. ZEOS is their best choice. ZEOS is your best choice as well.

**ZEOS. The Choice is Clear.**

# ZEOS<sup>®</sup> 386SX

## ZEOS Smashes the '386

**Your best reason yet to move up to a '386. Now you can own a complete ZEOS '386SX 16MHz hard drive system for *less* than comparable '286 systems.**

**The ZEOS '386SX. ZEOS performance, quality and support. ZEOS value. The Choice is Clear.**

**If you plan to buy a 16- or 20MHz 286 machine, think again.**

A fundamental change in computing is about to take place. Systems based on the 80286 processor will be replaced by systems based on the 80386SX.

As America's premier manufacturer of 80386 based systems, we've designed the new ZEOS 386SX to provide everyone with a window to the future. A future of '386 speed and performance at a fraction of what you would expect to pay.

And ZEOS knows '386 systems better than anyone. After all, PC Magazine chose ZEOS above 57 other companies for "For Overall Excellence" in their recent '386 Blockbuster issue.

The new ZEOS 386SX simply runs circles around '286 based machines. PC magazine noted that the ZEOS 16MHz 386SX compares "favorably with the 20MHz '286 machines reviewed in 'The 80286: Unsafe at Higher Speeds?'" (PC Magazine, December 27, 1988).

So forget those 16- and 20MHz '286 machines forever. The ZEOS '386SX-16 "blows 'em right out

of the water." As PC Magazine says, "386SX-based machines are the right choice..." and the new ZEOS 386SX is the right choice for you.

**30 Day Absolute Satisfaction Guarantee. One Full Year Limited Warranty.**

If a company believes in their product, they should stand Rock Solid behind it. That's why your new ZEOS 386SX hard drive system includes our famous 30 Day Absolute Satisfaction *Money Back* Guarantee, One Full Year Limited Warranty and Express Parts Replacement Policy.

**24 Hour a Day Sales and Toll Free Technical Support!**

And talk about service! ZEOS is the only computer company in America standing by ready to help you *Toll Free, 24 hours a day, 365 days a year.* Nobody supports their customers like ZEOS!

Order your new ZEOS 386SX now with confidence. Your choice of ZEOS quality and performance is *Guaranteed*. Order now by calling 800-423-5891.



# Only \$1695. Price Barrier!



## The New ZEOS 386SX Hard Drive System. Below '286 Prices! Only \$1,695

*The future is now!*

*Why be left behind with yesterday's '286 technology? This fast new ZEOS 386SX system is your high performance ticket to '386 computing power. It's actually faster and yet less expensive than comparable '286 systems.*

- 80386SX-16 CPU, 8/16MHz Dual Speed Keyboard Selectable. Reset/Turbo Buttons.
- 512K DRAM, expandable to a System Total of 16MB.
- Shadow RAM and EMS capability.
- Fast 32MB Seagate 138R Hard Drive with autopark, 1.2MB Teac floppy drive.
- Ultra high speed Hard/Floppy controller. 1:1 interleave, High Speed transfer.
- Genuine Hercules® brand graphics controller. High-Res Amber Display with Tilt/Swivel.
- ZEOS/RS Enhanced Tactile/Click keyboard.
- 2 High Speed Serial Ports plus one Parallel and one Game Port.
- 6-16, 2-8 bit expansion slots. 80387SX support.
- Rugged ZEOS space saver case. Security lock and LED indicators.
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.



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a year.

# ZEOS'386 Systems "For Overall Excellence..."

PC Magazine, May 30, 1989

Complete ZEOS 20MHz '386  
System. 80MB SCSI Drive!

**Only \$2995**

16MHz systems from \$2295!

The standard by which others  
are measured! Featuring 64K  
CACHE (twice that of most com-  
petitors) providing Zero-Wait  
State performance vastly superior  
to page/interleave memory  
schemes. Incredible Value.

- High speed Zero-Wait 64K read  
and write-back SRAM CACHE.  
The fastest method known.
- Genuine 32-bit Intel 80386-  
20MHz CPU.
- 1MB of Zero-Wait DRAM  
Expandable to 16MB.
- Fast 80MB, 28ms SCSI  
Seagate Hard Drive, Teac®  
1.2MB Floppy Drive.
- High speed HDD/FDD SCSI  
Host Adaptor with Software.
- Genuine Hercules® brand  
graphics controller. High-Res  
Amber Display with Tilt/  
Swivel.



Performance Comparisons using PC Labs Benchmark Series  
Release 4:

	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/16 Desktop	3.58	13.62	0.58
ZEOS 386/20 Desktop	2.87	10.82	0.38
IBM PS/2 Model 70-E61	4.09	16.04	0.75
Compaq Deskpro 386/16	4.12	15.47	0.75

- 101 Key ZEOS Tactile/Click  
keyboard.
- 2 High Speed Serial Ports plus  
one Parallel and one Game port.
- 1-32, 6-16 and 1-8 bit slots.
- 80387 math coprocessor support.
- Rugged ZEOS 5-bay case.  
Including Security Lock and  
LED indicators.
- Includes ZEOS 24 Hour a Day  
Toll Free Technical Support and  
Customer Satisfaction package.

Options Galore: Including 14"  
VGA, add only \$595. And an in-  
credible selection of hard drives:  
SCSI, RLL, ESDI or MFM and  
virtually any other add-on you  
could want!

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Open 24 Hours a day, 365 Days a year.

"Out of 104 machines from 58 companies... For overall excellence we selected ZEOS International's 386-16 and 386-20" *PC Magazine, May 30, 1989*

The Editors of *PC Magazine* came to this conclusion after investing "25,000 hours of work by 60 people testing and reviewing 104 '386 PCs". The review was thorough and their conclusion specific. Simply, that out of all the manufacturers in the world, ZEOS offers you the very best '386 Value.

In all areas, ZEOS machines are top performers. With uncompromising attention to quality and detail throughout. Not only do ZEOS systems themselves afford you the very best *Values* in computing today, they're backed up by the strongest after sales support in the industry.

At ZEOS we feel that if a company believes in its products it should stand Rock Solid behind them.

That's why ZEOS offers Toll



"Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road. Things like quality of construction, reliability, expandability, and ease of service."

*PC Magazine, On "What Makes an Editor's Choice"*

**Free Technical Support 24 Hours a day, seven days a week, 365 days a year!** At ZEOS, we believe in standing by our customers whenever they need us.

Then add our 30 Day Absolute Satisfaction *Money Back Guarantee*, One Full Year Limited Warranty and Express Parts Replacement Policy. You've got the best.

And when you order your ZEOS '386 you can have your pick from the industry's broadest selection of options. As *PC Magazine* said, ZEOS offers "more options than even the most configuration hungry hound could possibly need!"

Quality, Performance, Reliability and Support. *Overall Excellence.* That's why ZEOS is *PC Magazine's* #1 choice. And that's why ZEOS is *your best choice* as well. So pick out that dream machine today and order it now with confidence. Your choice of ZEOS excellence is Guaranteed. Order now by calling 800-423-5891.

**Complete 25MHz '386 Vertical System. 80MB SCSI Drive!**

**Only \$3995**

*Complete 33MHz systems only \$4995!*

ZEOS 25MHz and 33MHz 80386 systems are the fastest, most advanced available anywhere. Government Computer News calls the ZEOS 386-33 "arguably the fastest MS-DOS and OS/2 micro in the world." Review after review, these ZEOS systems are selected as the best price/performance buys. A power user's dream!

- Ultra High speed Zero-Wait 64K SRAM CACHE.
- Genuine 32-bit Intel '386-25 or 33MHz CPU.
- 1MB of Zero-Wait DRAM Expandable to 16MB.
- Fast 80MB, 28ms SCSI Seagate Hard Drive, Teac® 1.2MB Floppy Drive.
- High speed HDD/FDD SCSI Host Adaptor with Software.



Performance Comparisons using PC Labs Benchmark Series Release 4:

	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/25 Desktop	2.29	8.37	0.33
ZEOS 386/33 Desktop	1.67	6.43	0.27
IBM PS/2 Model A	2.27	8.33	0.60
Compaq Deskpro 386/25	2.36	8.59	0.37

- Genuine Hercules® brand graphics controller. High-Res Amber Display with Tilt/Swivel.
- BIOS and Video Shadow RAM plus EMS support.
- ZEOS Tactile/Click keyboard.
- 2 High Speed Serial Ports plus one Parallel and one Game port.
- 1-32, 6-16 and 1-8 bit slots.
- 80387 math coprocessor support.
- Rugged ZEOS 5-bay case.
- Security Lock, LED indicators.
- Includes ZEOS 24 Hour a Day Toll Free Technical Support.

Many options available: Including 14" VGA, add only \$595. Plus a large selection of SCSI, RLL, ESDI or MFM hard drives and more.

**Order Now Toll Free  
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# Comput

## **Right Now. Guaranteed!\***

Yes, we can ship your new ZEOS® '286 or '386 today! We've built up an extra supply of the hottest selling computers in America. The celebrated ZEOS 286-12 and PC Magazine's Editor's Choice—the ultra fast ZEOS 386-16.

Take your pick now for immediate delivery. These are both *complete*, genuine ZEOS Zero-Wait state systems. Both include an ultra-fast Seagate hard drive and all the other goodies. And they're ready to ship. *Right Now.*

Here's how it works. We have these extra systems pre-built and ready to ship. They include both High Resolution Monochrome and VGA systems. While supplies last, we will ship either of these systems to you the day you order subject to these conditions:

1. Your order must be received by 1PM Central Time.
2. Credit Cards are subject to credit card authorization.
3. Orders must be for our standard 286-12MHz system or 386-16MHz system, either monochrome or VGA. Any other systems or upgrades are custom built and will take slightly longer.

## **\*Our Guarantee to You:**

If we fail to ship your system under the conditions outlined, we will ship it *at our expense* as soon as it is ready. All systems are fully burned in and tested. Each system includes our 30 day Money Back Guarantee and One Full Year Limited Warranty. *Toll Free* technical support and Express Parts Replacement are included too!

This offer is good only as long as these pre-built

## **Complete ZEOS 12MHz '286 with 32MB Hard Drive!**

# Only \$1,395

For VGA color add \$595

**FREE Shareware Disks Too!**  
25 Software Programs Included  
Every system will include 5 ready to run Shareware programs on free disks. Included are programs for Word Processing, Spread Sheets, Educational, Financial, Business, Games and more. With Shareware you can try the programs first before you register them with the author. What a great idea!

## **Standard Features Include:**

- 80286 12 CPU, 6/12MHz Dual Speed keyboard/hardware selectable. Reset and Turbo buttons right up front.
- Zero-Wait State DRAM, 512K expandable to 4MB on the mother board (16MB System Total). EMS Capability on board.



Performance Comparisons using PC Labs Benchmark Series Release 4:

	80286 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 286/12 Desktop	4.78	18.84	0.72
IBM PC AT (8MHz)	8.95	35.60	1.32
IBM PS/2 Model 50	7.20	26.34	1.05

- Fast 32MB Seagate 138R Hard Drive with auto-park, 1.2MB Floppy Drive.
- Ultra high speed Hard/Floppy controller: E-I interleave, 800 KB/sec transfer rate.
- Genuine Hercules® (Yes, Hercules!) Brand graphics card. High-Res Amber Display with Tilt/Swivel Base.
- ZEOS Enhanced 101 Key Keyboard with our Pleasant Tactile/Click Feel.
- Serial and Parallel Printer Ports.
- Clock/Calendar with Battery Backup.
- 6-16 and 2-8 bit expansion slots.
- 80287 support, up to 12 MHz.
- Heavy Duty Case Complete with Security Lock and LED indicators.

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# ers Now! <sup>SM</sup>

systems remain in stock; please give us a call to verify availability. This offer does not apply to other ZEOS systems or custom configurations.

*Immediate shipment is only part of the story.*

ZEOS builds Rock Solid computers. That's why we offer you our 30 Day Money Back Guarantee, Toll Free technical support and Full One Year Limited Warranty. Compare that to the others. Then compare performance.

Performance is what ZEOS is all about. If you're buying a computer you may as well buy the fastest. The ZEOS 286-12 is *the fastest* in its class. It features true Zero-Wait state operation with speeds close to many 386 systems!

Or select the ZEOS 386-16. The Editors of *PC Magazine* did. In fact they selected the ZEOS '386

as *Editor's Choice*. And is it ever a screamer. As *PC Magazine* said, "This ZEOS 386-16 blows away every other computer..." Another *PC Magazine* editor said "Don't pass up the ZEOS... solid construction, flexible design and escape-velocity performance make it a top flight choice."

*PC Resource Magazine* put it this way "ZEOS... provides quality comparable with the IBM or Compaq and does so for about 70% of the cost." *Personal Computing* simply says "The best value we've come across so far."

We couldn't have said it better ourselves.

And these are the machines that we have ready to ship to you *right now*. Rock solid block buster ZEOS machines with quality and performance that is, in a word, *Guaranteed*. Order now by calling 800-423-5891.

Complete ZEOS 16MHz '386  
with 80MB 28ms SCSI Drive!

**Only \$2,495**

For VGA color add \$595



Standard Features  
Include:

- Genuine 32-bit Intel 80386-16MHz CPU.
- High speed Zero-WAIT 64K SRAM CACHE.
- 1MB of

Zero-Wait DRAM Expandable to 16MB system total.

- Fast 80MB, 28ms SCSI Seagate Hard Drive, 1.2MB Floppy Drive.
- Ultra high speed Hard/Floppy SCSI controller.
- Genuine Hercules® Brand graphics card, High-Res Amber Display with Tilt/Swivel Base.



Performance Comparisons using PC Labs Benchmark Series Release 4:

	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/16 Desktop	0.58	13.62	0.58
IBM PS/2 Model 70-E61	4.11	16.14	0.77
Compaq Desktop 386/16	4.12	15.47	0.75

- 101 Key ZEOS Tactile/Click keyboard.
- High speed Serial and Parallel Ports.
- 1-32, 5-16 and 2-8 bit slots.
- 80387 math co-processor support.
- ZEOS 5-bay case with security lock and LED indicators.

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St. Paul, MN 55112 USA



# 10 Good Reasons To Buy From ZEOS®

**NEWSFLASH!**  
ZEOS International  
Announces 24 Hour  
a Day Toll Free  
Technical Support!

Effective July 15, 1989, ZEOS makes industry history by launching 24 Hour a day, Toll Free Technical and Sales Support.

That's right, ZEOS is now open to serve our customers 24 Hours a day, 365 days a year! There is no other computer company in the world so dedicated to its customers. Now, no matter what time you need help, ZEOS will be there. Day or night. Toll Free.

During the day there are perhaps thousands of computer companies ready to sell you a computer. Many offer technical support if you are willing to pay for the call. And when they get tired, they turn off the lights and go home. Unfortunately, that may be just when you need their help.

At ZEOS, we never sleep. Because somewhere out there, there might just be a customer who needs us. Even at 3:30 A.M.

It's comforting to know. As night encompasses your home or your office, your research lab or your classroom, away in St. Paul sits a small group of very qualified and dedicated people. They're camped there, around the telephone. Just waiting for that small chance. The chance that you might be the one tonight who needs their help.

Across the vast expanse of North America, whether you're in Newfoundland or Hawaii, Florida or Alaska, or anywhere in between—ZEOS is there for you. Any time of the day or night. Any hour or day of the year. We're waiting to help. And you don't even have to pay for the call.

## Reason #1

### "Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are bench mark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times thus far in 1989. And "Overall Excellence" are the very words *PC Magazine* used in comparing ZEOS systems to all others.

## Reason #2

### Dazzling Performance.

In their February 28th '86 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '86 blows away every other computer... a smart choice" is what they said. And in a recent review, *Government Computer News* said the ZEOS 33MHz '86 is "arguably the fastest MS-DOS and OS/2 micro in the world".

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

## Reason #3

### Exceptional Quality.

*PC Resource Magazine* put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

## Reason #4

### Value.

*InfoWorld* says, "We find the ZEOS '86 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent." *Personal Computing* said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy".

## Reason #5

### Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

## Reason #6

### 24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we're open around the clock. For *your* convenience. If you buy a product from us we feel we should be there to help, 24 Hours a day. Our Help Lines are Toll Free too. Because you shouldn't have to pay for the call.

## Reason #7

### Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

## Reason #8

### A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are sighted for *Overall Excellence*, for *Excellent Value*, as the *Right Choice* and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The system and the support. That means more to us than anything.

## Reason #9

### Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

And now the ZCARD! It's your very own ZEOS Credit Card and you can apply today. With the ZCARD you can charge your ZEOS purchases and pay in easy monthly installments. It's just like a Bank Card. *Fill out and mail your ZCARD application now!*

## Reason #10

### You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, we *Guarantee* it!



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Now you can apply for your own ZEOS Credit Card. It works just like a MasterCard or Visa for ZEOS purchases. Fill out your ZCARD Application and mail it today. We'll give you a call as soon as your credit line is established! Mail the completed application to:  
ZEOS International  
ZCARD Processing Center  
530 5th Avenue N.W., St. Paul, MN 55112

## a. Your Personal Information

Requested Line of Credit \$ \_\_\_\_\_

Your Name First Initial Last Date of Birth Mo Day Yr.

Present Address Street Apt. # City State Zip

Social Security Number \_\_\_\_\_ Home Phone \_\_\_\_\_

Date of Residence Month Year Monthly Payment \$ \_\_\_\_\_ ☐ Bay ☐ Rent ☐ Other

Previous Address \_\_\_\_\_

Date of Residence From To

Your Employer (If self-employed, see mar. panel.) \_\_\_\_\_

Date of Employment Mo. Yr. Position \_\_\_\_\_

Monthly Income Gross \$ Net \$

Employer's Address Street \_\_\_\_\_

City State Zip Business Phone \_\_\_\_\_

Previous Employer \_\_\_\_\_

Date of Employment From To

Other Income: I have received since (Date) \_\_\_\_\_

Income from a divorce, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income Gross \$ Net \$

Name and Address of Nearest Relative Not Living With You \_\_\_\_\_

Relationship \_\_\_\_\_

## b. Credit Information

Include joint applicant's information, if joint account requested.

Bank Account Bank Name ☐ Checking ☐ Savings

Address \_\_\_\_\_

Bank Account Bank Name ☐ Checking ☐ Savings

Address \_\_\_\_\_

Bank Loan Bank Name Address \_\_\_\_\_

Reference \_\_\_\_\_ Payment \_\_\_\_\_ Balance \_\_\_\_\_

Bank Card Bank Name Address \_\_\_\_\_

Reference \_\_\_\_\_ ☐ VISA ☐ Mastercard Payment \_\_\_\_\_ Balance \_\_\_\_\_

Other Credit Card Reference Bank Name Address \_\_\_\_\_

Payment \_\_\_\_\_ Balance \_\_\_\_\_

Other Credit References Payment \_\_\_\_\_ Balance \_\_\_\_\_

Account No. \_\_\_\_\_ Expires \_\_\_\_\_

Driver's License No. \_\_\_\_\_ State \_\_\_\_\_ Expires \_\_\_\_\_

# Application And Agreement

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ Joint Credit with another person.

Complete entire application.

☐ Individual Credit but rely on income

or assets of another person as a basis

for repaying the credit requested.

Complete entire application.

☐ Individual Credit Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two

years' residence and employment history. This will enable your

application to be processed as quickly as possible. If you are

self-employed, please be sure to complete section "d" below.

## Notice to Wisconsin Applicants

You must disclose your marital status:

☐ married

☐ unmarried

☐ legally separated

## c. Joint Applicant's Personal Information

\*If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.

Joint Applicant's Name First Initial Last

Date of Birth Mo. Day Yr. Social Security Number \_\_\_\_\_

Address Street Apt. # \_\_\_\_\_

City State Zip \_\_\_\_\_

Date of Residence Month Year Home Phone ( ) \_\_\_\_\_

Employer \_\_\_\_\_

Date of Employment Mo. Yr. Position \_\_\_\_\_

Monthly Income Gross \$ Net \$

Employer's Address Street \_\_\_\_\_

City State Zip Business Phone \_\_\_\_\_

Insurance Option ☐ Single CreditCare® ☐ Joint CreditCare®

## d. Self-Employed Information

Complete this section only if you are self-employed.

Business Name \_\_\_\_\_

Business Address \_\_\_\_\_

☐ Proprietorship ☐ Corporation ☐ Partnership Business Phone ( ) \_\_\_\_\_

Description of Business \_\_\_\_\_

Your Position \_\_\_\_\_ In Business Since \_\_\_\_\_

Your annual income from business \_\_\_\_\_ Business' annual income (gross) (net) \_\_\_\_\_

You must provide at least one of the following:

1. Business Bank \_\_\_\_\_

( ) Telephone \_\_\_\_\_ Personal Banker's Name \_\_\_\_\_

2. Accountant's Name \_\_\_\_\_

( ) Telephone \_\_\_\_\_

3. Financial statement on business attached.

## e. CreditCare® Insurance Option

☐ Yes, protect my revolving credit account with the CreditCare® Plan checked below:

☐ Single CreditCare® ☐ Joint CreditCare®

I understand that the CreditCare® coverage described herein is optional and not required to obtain credit. Rates and conditions are shown in the CreditCare® Insurance Election.

Buyer (Insured) \_\_\_\_\_

Co-Buyer (Insured) \_\_\_\_\_ (Life Only) \_\_\_\_\_

I agree to the terms and conditions of this Retail Installment Charge Account and Credit Agreement (Forms 922 ZEOS) which are incorporated herein by reference. I read and received a copy of my Agreement before making any purchase under this account. NOTICE TO BUYER: (1) DO NOT SIGN THIS AGREEMENT BEFORE YOU READ IT OR IF ANY OF THE SPACES FOR AGREED TERMS ARE BLANK. (2) YOU ARE ENTITLED TO AN EXACT, COMPLETELY FILLED-IN COPY OF THIS AGREEMENT. KEEP IT TO PROTECT YOUR LEGAL RIGHTS. (3) FINANCE CHARGES NOT EXCEEDING THOSE PERMITTED BY LAW WILL BE CHARGED FROM MONTH TO MONTH. (4) YOU MAY PAY ALL OR ANY AMOUNT OWED IN ADVANCE AT ANY TIME WITHOUT PENALTY. (5) YOU MAY UNDER CERTAIN CIRCUMSTANCES REDEEM PROPERTY THAT IS REPOSSESSED OR REQUIRE RESALE OF SUCH PROPERTY. (6) THE SELLER MAY NOT ENTER YOUR PREMISES OR COMMIT ANY BREACH OF THE PEACE TO REPOSSESS PROPERTY. (7) YOU HAVE A RIGHT TO CANCEL. (8) FINANCE CHARGES ARE SOLICITED IN PERSON BY SELLER. (9) THIS IS A CONSUMER CREDIT TRANSACTION. (10) MARIED WISCONSIN APPLICANTS ACKNOWLEDGE RECEIPT OF THE "NOTICE TO MARIED APPLICANTS" PROVIDED IN THE AGREEMENT.

Buyer \_\_\_\_\_ Date \_\_\_\_\_

Buyer \_\_\_\_\_ Date \_\_\_\_\_

ZEOS \_\_\_\_\_ Date \_\_\_\_\_

Seller's Signature \_\_\_\_\_ Date \_\_\_\_\_

FOR MARIED WISCONSIN APPLICANTS: I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

Buyer \_\_\_\_\_ Date \_\_\_\_\_

Buyer \_\_\_\_\_ Date \_\_\_\_\_

Buyer \_\_\_\_\_ Date \_\_\_\_\_

(EXC. AK, AR & HI)

COMPUTERS  
80386SX-BASED PCs

standard 640 by 480 resolution, the Swan VGA can display 16 colors in extended 800 by 600 mode. The Swan VGA card includes software drivers for *Microsoft Windows/386*, *Lotus 1-2-3*, *Ventura Publisher*, *GEM*, and *AutoCAD*. It has both a 15-pin analog and a 9-pin digital connector.

One of the most unusual and welcome features included with the Swan 386SX was a well-written and accessible user manual. Although that manual lacks an index, the table of contents should guide any level of user to the information needed. The manual is not only informative about this machine, but will help newcomers understand PC jargon. All terms are defined in a glossary, and the appendixes do a good job of covering the technical aspects of the machine.

While the Swan 386SX is hefty and not much of a performer, it is solidly constructed—and at a rock-bottom \$1,499, the price is right. Helpful staff and an informative manual add to the Swan's attractiveness.

TWINHEAD CORP.

## Twinhead Superset 490

by Susan L. Hayes

Twinhead International better hope to sell a lot of computers if the company is looking to carpet its new 144,000-square-foot factory in Taiwan, built to supplement the original facility operating at 120 percent. This rapidly growing corporation has U.S.-based offices in Silicon Valley and New Jersey. Twinhead sells products through a network of OEMs and distributors. It offers a new and exciting approach to computer design in its 386SX machine, the Superset 490, and a refreshing promise of service and commitment to its customers—all without costing those customers an arm and a leg.

The Twinhead 386SX is a sturdy, compact small-footprint model that inside and out resembles a sleek, well-trained athlete. The impressive organization of the Twinhead machine is carried over into the user-friendly documentation, which provides elaborate diagrams and color photographs as well as straightforward explanations about every aspect of the machine. Its well-organized format allows the advanced user to flip readily to any particular



Twinhead's intelligent approach to small-footprint design is evident in its Superset 490 machine. Four expansion slots run horizontally and one of the three drive bays sits on its side. Twinhead's performance may not be a plus, but its price is—\$2,999 with 1MB of RAM, a 40MB hard disk, and a mouse.

section that he or she might need.

The Qtronix Enhanced keyboard offers a firm touch. The LED indicators are placed together in the upper right-hand corner. The Backslash key is located below and to the left of the Enter key—convenient enough that you're not contorting your hand to get to it, but out of the way so that you're not forever hitting it by accident. Other keyboards are available on request.

The Twinhead 386SX machine currently has an FCC-approved Class A rating, but a Class B rating is expected soon. The system comes configured with mouse, parallel, and serial ports, and a hard drive controller already built in. So while its four available slots (three 16-bit and one 8-bit) may at first seem limiting, all are basically free for add-ins. The space-saving expansion card is vertical, which cuts off a few inches in the overall width and depth of the machine.

Twinhead has taken its own 286 motherboard, which uses a combination of discrete logic and surface-mount VLSI chips, and added a daughtercard with a Phoenix NEAT 286 Dual Mode BIOS that has a P9 modification to support the 80386 CPU.

The motherboard can hold up to 8MB



### FACT FILE

**Twinhead Superset 490**  
Twinhead Corp., 30 Chapin Road, Unit K, P.O. Box 702, Pinebrook, NJ 07058, (201) 808-1688  
**List Price:** With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$1,699; with 40MB hard disk, VGA card, DOS 3.3, mouse, \$2,999  
**In Short:** Those attracted by innovation will experience love at first sight with the Twinhead Superset 490. Although not a speed demon, this machine's features and Twinhead's commitment to customer service will help it to build a loyal following.

CIRCLE 605 ON READER SERVICE CARD

of 100-nanosecond SIMM chips and up to 16MB more with an add-in card. In the Twinhead, shadow RAM is provided for both the video and the BIOS, with EMS 4.0 support built into the motherboard. With 1MB RAM, it is recommended to allocate the customary 640K to DOS, 384K to shadow or extended memory.

This 16-MHz computer runs at zero wait states and clocks a bus speed of 8 MHz regardless of CPU speed. The Twinhead does not use interleaved memory (unnecessary at zero wait states) or a memory cache. The system unit features a 150-watt



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power supply, switchable from 115V to 230V.

Our tested unit came with Twinhead's own hard disk controller, which is built into the drive itself. With all its circuitry located on-board, the hard disk is supposed to offer a higher level of integration. Because Twinhead's AT-Bus Interface requires only one processor, it also requires fewer chips, thereby cutting down on costs and improving performance. In addition, because the hard disk and controller exist as one, you can add the hard disk without taking up an expansion slot with a controller, and you're not forfeiting your option to daisy-chain on other drives.

And now for something else completely different, again from Twinhead: its own Magic Combo video graphics card and driver. The card is placed parallel to the motherboard, and by itself is able to emulate color software on monochrome monitors. It can convert a 640-by-200-pixel color display into a 720 by 300 display in 16 shades of gray. Supporting Hercules and Hercules Plus software, and ADA and CPA using a Twinhead-designed ASIA chip, the emulation is accomplished through hardware. But if you need VGA, don't despair: all you need to do is add the VGA adapter, complete with a VGA feature connector, which has no present use but allows you to maintain complete compatibility with IBM. The monitor provided with our test unit was a VisualPro, which allows toggling back and forth between monochrome and color.

Twinhead keeps its commitment to partnership with its competitive pricing. For \$1,699 you get the ST-506 system with 1MB RAM; 1.2MB floppy disk drive; one parallel, one serial, and one mouse port built in; an Enhanced keyboard; the Magic Combo card; the AT bus controller; and a floppy disk drive controller. What Twinhead considers a fully configured system also includes a 40MB hard disk, a VGA video adapter, DOS, and a three-button mouse. Although these are the only hard disk options available from Twinhead, other hard disk options are available from the dealer.

In the all-important 80386 Instruction Mix test, the Twinhead Superset 490 finished respectably in the middle of the group. On the DOS File Access tests of both large and small records the Superset 490 demonstrated average performance, making the benefit of the built-in controller questionable.

Although it may not be the fastest kid



## EDITOR'S CHOICE

## • Everex Step 386is

Everex took the low road to SX computing when it designed the Step 386is: it simply added a 386SX daughtercard to its 16-MHz 286 computer, and that was that. But the results are another story—this machine has a fast processor and a speedy hard disk that both keep up with full-fledged 16-MHz 80386-based computers. This machine turned in first- and second-place finishes on every benchmark test save video: Everex doesn't currently supply VGA displays. You'll even save space on your desktop: Everex managed to cut down on width by eliminating two drive bays while saving all eight expansion slots. If the price seems a little steep, remember that Everex is sold through dealers—factor in a big discount, and the price falls from high end to low end. The Everex Step 386is fulfills the original promise of the 386SX: 386 performance at just above 286 prices.

If you're willing to go down a notch in performance for a commensurate cut in price, check out the Club AT Model 316SX and the Spear 386/16SX. These machines are so similar in layout, construction, performance, and cost that it's tough to make distinctions between them. They both come in small boxes with eight expansion slots and three half-height drives, and their motherboards are veritable twins. Both offer 1MB of RAM, a 60MB hard disk, a fully configured VGA system, and DOS for about \$2,800.

When you make your buying decision, don't forget about IBM. The IBM PS/2 Model 55 SX was announced too late to appear in this roundup, but at \$3,895 for a VGA system with 2MB of RAM and a 30MB hard disk, it may be worth considering for those who esteem the Big Blue label. It doesn't boast blinding speed, but the Model 55 SX is so small and well designed that any marginal performance shortfall may be of secondary importance.

on the block, the Twinhead is a well-constructed, space-saving computer at an affordable price. So if you're looking for a decent performer backed by lots of support and service, check this one out.

## ZEOS INTERNATIONAL LTD.

## Zeos 386-16/SX

by Catherine D. Miller

The 386SX offering from Zeos, the Zeos 386-16/SX, is another well-designed yet inexpensive machine in the Zeos family of affordable performers. At just \$2,392 for a monochrome system with 1MB RAM, a 65MB hard disk, and DOS, the Zeos gives you good 386 performance for a good 286 price.

In fact, Zeos sells a similarly equipped 16-MHz 286 system for only \$150 less. The list price for the basic configuration of each is the same: \$1,895. For both systems this price includes a 32MB hard disk with monochrome graphics and monitor. Oddly enough, the 16-MHz 286 is shipped with 1MB RAM, while the 386SX is shipped with only 512K RAM. The beauty of the 80386SX chip is its true protected-mode multitasking capabilities, and multitasking software making use of these capabilities requires lots of RAM.

Turbo and reset buttons grace the front panel of a good-looking downsized case (6 by 17 by 16.5 inches, HWD). You can also switch the speed of the microprocessor down to 8 MHz with a software command. LED indicators for power, disk, and turbo mode are readily accessible on the front panel. The power switch is found on the right side, in the rear.

The keyboard has a good clicky feel. The keys are high and well spaced, making the keyboard pleasant to type on.

Enclosed in the case are three half-height drive bays. A 230-watt power supply from Tecu with four AA alkaline batteries strapped to its side resides behind the drive bays. All Zeos models, including our review unit, are shipped with a fast Seagate 32MB hard disk rated at 28 milliseconds—unless you specifically request another of the nine Seagate and Wren drives available through Zeos. This drive came in fourth on both DOS File Access tests.

The Zeos standard Adaptec RLL controller card can handle two floppy and two hard disk drives. The 1.2MB 5¼-inch floppy disk drive included with our review

unit was from TEAC; Mitsubishi drives are also available.

Six 16-bit and two 8-bit expansion slots grace the system board. The motherboard, designed by Progressive, is set up so that the four banks of SIMM connectors are not hidden under drive bays and are easily accessible. Since only 512K RAM is standard, you may want to upgrade the system RAM.

Our evaluation unit came equipped with 1MB 100-nanosecond DRAM on the system board, occupying two SIMM banks. The Zeos 386-16/SX can handle 8MB RAM on the motherboard and the full 16MB that the 80386SX supports. It uses paged/interleaved memory, which switches between banks and allows the processor to access several banks sequentially. In addition, it turned in good performance times on our Conventional Memory benchmark test, settling comfortably in the top half of the pack.

The 80386SX microprocessor is surface-mounted between the expansion slots and the SIMM connectors. It requires 1MB RAM to run at 16 MHz with no wait states. The system we reviewed came



The Zeos 386-16/SX is a terrific all-around choice with its low price, small footprint, and solid if not stellar performance. A VGA system with 1MB of RAM and a 65MB hard disk sells for \$3,087.



#### FACT FILE

**Zeos 386-16/SX**  
Zeos International Ltd., 530 Fifth Ave. NW  
#1000, St. Paul, MN 55112; (800) 423-5891,  
(612) 633-4591.  
List Price: With 512K RAM, 32MB hard disk,  
1.2MB 5 1/4-inch floppy disk drive, monochrome  
monitor, \$1,895; with 1MB RAM, 65MB hard disk,  
DOS 3.0, \$2,392; with VGA monitor, \$3,087; with  
32MB hard disk, 80387SX coprocessor, DOS  
4.01, \$3,532.  
**In Short:** The Zeos 386-16/SX is a well-designed  
and inexpensive small-footprint 386SX computer.  
Although not one of the latest 386SX machines  
tested, it turned in solid performance times on all  
our benchmark tests.

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equipped with an 80387SX math coprocessor in the nearby socket. Although Zeos placed in the top half in our Instruction Mix benchmark test, which measures processor speed, its performance on Floating-Point Calculation fell into the bottom half of the group. The Chips and Technologies 386SX NEATSX chip set supports the processor.

Of the six systems equipped with coprocessors, this machine's coprocessor-dependent times were the worst. The Zeos 386-16/SX was the only system in this early roundup of 386SX computers to incor-

porate a BIOS designed specifically to work with the 80386SX chip—the Pro-386SX BIOS.

An 8-bit 286 I/O card supporting two serial, one parallel, and one game port is standard Zeos fare. You get one serial and one parallel port with any system, but to increase your system port capacity you'll have to take a slot.

Our evaluation unit included a Paradise VGA Plus 16 card and Tatum's Model CM-1496 monitor. The Paradise VGA card features 16-bit autosensting, meaning that it analyzes the bus timing and will work in either an 8-bit or a 16-bit slot. When placed in a 16-bit slot, as it was here, it will take advantage of 16-bit BIOS and improve performance significantly. The card supports extended VGA resolution, which includes displaying 800 by 600 pixels in 16 colors.

PC Labs' video benchmark tests were run without loading special drivers to take advantage of video shadow RAM. Zeos's video performances were generally somewhere in the middle of the pack, but they

would have been improved had this driver been loaded.

A separate setup manual includes some technical information and details each step of getting the Zeos 386-16/SX ready for work. It also includes a diagram of the system board and a small troubleshooting section. The brief system manual designed for the new computer user includes a table of contents, glossary, and index, but few technical details.

The Zeos 386-16/SX offers a solid price/performance ratio in an attractive package. The main limitation is the base system's 512K RAM. But if you want a monochrome system with a reasonably fast 32MB hard disk and 386 multitasking capabilities, the \$1,895 price tag is hard to beat.

*Henry Fersko-Weiss is a frequent contributor to PC Magazine. Susan L. Hayes is an editorial assistant at PC Magazine. Catherine D. Miller is a staff writer at PC Magazine. Salvatore P. Ricciardi is a senior programmer at PC Labs.*

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### DATA 386-20<sup>A</sup>

#### STANDARD CONFIGURATION

- Intel 80286-20 microprocessor
- 1MB base memory RAM, expandable to 16MB of 32-bit memory
- 64K of 4-way associated, 25ns static RAM cache
- Socket for Intel 80287 numeric coprocessor
- 1 32-bit, 16-bit and 8-bit slot
- Dual hard/floppy controller
- 1 2MB 5.25" floppy drive
- Enhanced 101-key "Click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

#### AVAILABLE OPTIONS

- Full-size vertical case or mini-tower case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB using DIMMs and/or SIMMs
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- 40MB to 300MB hard drives in MFII, RLL, ESDI, or SCSI interface
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- 40MB - 120MB tape backup drive
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Case/Configuration	Standard	Optional	Extended
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11.5" Mini-Tower	\$1,399	\$1,599	\$1,799
11.5" Full Tower	\$1,499	\$1,699	\$1,899
11.5" Full Tower	\$1,599	\$1,799	\$1,999

### DATA 386-25<sup>A</sup>

#### STANDARD CONFIGURATION

- Intel 80286-25 microprocessor
- 1MB base memory RAM, expandable to 16MB of 32-bit memory
- 64K of 25ns static RAM cache
- Built-in ROM setup and diagnostics with EGA/VGA resolution
- Socket for Intel 80287-25 or 80287 numeric coprocessor
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- 1 2MB 5.25" floppy drive
- Enhanced 101-key "Click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

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- Full-size vertical case or mini-tower case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessors: 80287 or 80287
- 40MB to 300MB hard drives with MFII, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drive
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color) or extended VGA (800x600 up to 1024x768, color)
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### DATA 386-16<sup>M</sup> / -20<sup>M</sup> / -25<sup>M</sup>

#### STANDARD CONFIGURATION

- Intel 80286-16, -20, or -25 microprocessor
- 1MB base RAM, expandable to 16MB of 32-bit memory
- 25 MHz system features Intel 82385 cache controller with 32K 2-way set associative static cache
- LM 595 4.5 driver supplied
- Socket for Intel 80287 numeric coprocessor
- 1 32-bit, 16-bit and 8-bit slot
- Dual hard/floppy controller
- 1 2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
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#### AVAILABLE OPTIONS

- Full-size vertical case or mini-tower case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessors: 80287 or 80287
- 40MB to 300MB hard drives with MFII, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drive
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color) or extended VGA (800x600 up to 1024x768, color)
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#### STANDARD CONFIGURATION

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- Dual hard/floppy controller
- 1 44MB 5.25" internal HD
- 1 2MB 5.25" external diskette drive
- 20MB 40MB hard drive
- Enhanced 102-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 8 pin external monitor output port
- 100W power supply

#### AVAILABLE OPTIONS

- EGA gas plasma display
- Memory expansion to 640K, 1MB, 2MB, or 4MB
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# E-MAIL, The Global Handshake



ILLUSTRATION: JEANETTE ADAMS

by Luisa Simone

Through enhancements in rate structures, delivery options, and on-line extras, public e-mail services are growing more creative in their efforts to woo subscribers. And the most worthwhile goal of all—full interconnectivity among carriers—is finally within reach.

Say the words “electronic mail” and people will know exactly what you mean. Or will they? Certainly everyone understands that electronic mail allows you to transmit messages and other files to people down the hall or halfway around the world. And there’s no need to discuss its benefits, among which are near-instantaneous delivery and the elimination of conference calls.

This basic description, however, can encompass any number of products or services. Public carriers like AT&T Mail, Western Union Telegraph’s EasyLink, and MCI Mail—which form the main focus of this article—have traditionally catered to the individual subscriber. They resemble both the postal service and the phone company. Like a

post office, they maintain mailboxes for each individual user or business. As is the case with the phone company, all e-mail customers are listed in open directories.

Electronic mail is also available as an ancillary service from information providers like CompuServe or The Source. While most people subscribe to these for their extensive database offerings and the benefit of on-line conversations, each user is also automatically entitled to a private mailbox.

#### INTRACORPORATE E-MAIL

Companies like Dialcom and GE QuickComm have traditionally provided the means for intracorporate electronic communications. As with public e-mail services, all that's needed for subscribers to access these services is a modem and communications software. Known as value-added networks, these companies distinguish themselves with support and customization for large, even multinational, corporations.

Products like IBM PROFS, DEC All-in-1, Novell MHS, and DaVinci also fall under the general heading of e-mail. (See the sidebar "Gateway Technology: So Near, Yet So Far.") These are not e-mail services per se, but software that provides internal messaging capabilities for mainframes, minis, or LANs.

Viewed in such a linear manner, it may seem that there are some clear-cut distinctions among these various categories of e-mail. But the lines that separate them are becoming increasingly blurry. Gateway products make it possible to hook private, LAN-based e-mail systems into public carriers. Corporate providers are changing their rate structures to entice individual customers to sign up. Information services are expanding their e-mail systems to rival the delivery options of the public carriers. Even MCI's recent acquisition of a corporate e-mail service (RCA Mail from RCA Global Communications) points toward converging technology and increased competition.

The competition is fierce for a very simple reason. The size of the subscriber base remains the single most important consideration when choosing an electronic-mail system. E-mail services have (until recently) been closed-circuit systems: they required both correspondents to maintain mailboxes with the same carrier. In this sort of numbers game, potential customers asked two straightforward questions: Where do my business associates sub-

scribe? And how many other contacts can I make by joining a particular service?

In 1988, of the three public carriers reviewed here, EasyLink, with 175,000 active mailboxes, outdistanced both MCI Mail (100,000) and AT&T Mail (40,000). Both MCI and AT&T, however, have given their customers greater access by linking with other services. The long-standing proprietary link between MCI Mail and

**Potential e-mail users  
ask: Where do my  
business associates  
subscribe? And how  
many other contacts  
can I make through a  
particular service?**

CompuServe allows MCI subscribers to communicate with over 450,000 EasyPlex mailboxes. AT&T customers can now contact Dialcom's 140,000 subscribers via the first domestic X.400 link.

#### MESSAGING PROTOCOLS

The X.400 protocol promises to someday make interconnectivity among e-mail services a reality, thus offering subscribers to any participating service a host of electronic contacts. The X.400 protocol basically governs the structure of the electronic envelope in which a message metaphorically travels. Ratified by the CCITT (the French abbreviation for the International Telegraph and Telephone Consultative Committee) in 1984, X.400 was developed to provide a common way for all electronic-mail carriers to address messages. Theoretically, any correctly addressed message would travel to its destination—between different carriers—without a hitch.

Sending messages between carriers transparently is the first and most obvious benefit of X.400. Secondly, X.400 increases the ease with which vendors can transport binary data by separating the envelope from the actual content of the message. The only criticism of X.400 is that it

requires each message to be addressed thoroughly and exactly.

But that last little problem could be solved by the X.500 protocol. Ratified by the CCITT just last year, X.500 is a set of technical specifications for what could become a global electronic telephone book. With a directory in place (one so large that it would necessarily reside on several different networks), it would no longer be necessary to know the exact mailbox number for each correspondent. Addressing electronic mail might become as simple as entering someone's name, company, and city.

The X.500 protocol may require users to make some adjustments. Right now, when you are on-line, you immediately know when you have misaddressed a message. With X.500, users may have to get used to delayed feedback. Indeed, like paper mail (although still much faster), we may have to learn to live with "addressee unknown" error messages.

This move toward interconnectivity has in large part been inspired—even insisted upon—by the customers, not the vendors, of electronic mail. The Aerospace Industry Association (AIA) is currently providing the impetus for a large pilot program that uses the X.400 protocol to connect just about every rival e-mail carrier in the U.S. The seeds planted with that pilot program are already starting to bear fruit. As we go to press with this issue, Dialcom and MCI have announced an X.400 link that should be live by the fourth quarter of 1989. Telnet, U.S. Sprint's data communications company, also has gotten into the picture. A new X.400 link that connects its Telemail 400 messaging service, MCI Mail, and AT&T Mail, was expected to be operating by early summer.

One word of caution about the X.400 bandwagon: although all of the carriers involved in the pilot program have announced support of X.400, they still must work out the contractual revenue-sharing details for the messages that travel across systems. They also must either change the structure of their internal messages (to separate the envelope from the body of the message) or translate back and forth between their own formats and the X.400 format. In addition, the carriers must establish physical links between their networks.

#### EXISTING ALTERNATIVES

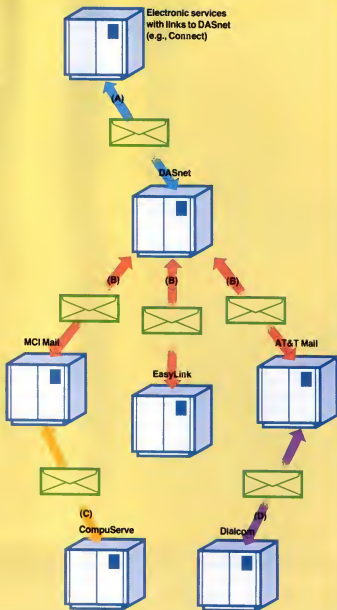
In the meantime, third-party vendors are offering translation services to those peo-

## CONNECTING E-MAIL SERVICES

This simplified chart of interconnections among services indicates the various types of connections and the benefits of each. First, proprietary links like the one between MCI Mail and CompuServe (A) allow subscribers of the services to communicate with one another. It is necessary, however, to know the exact mailbox ID of the person you wish to address.

DASnet is a third-party clearing house for electronic messages. Anyone can be a DASnet client; smaller electronic services like Connect provide a connection to DASnet (D) as part of their basic service. Businesses and even individuals can also subscribe to DASnet if they also maintain a primary mailbox on another service. In turn, DASnet "subscribes" to most major carriers, including MCI Mail, AT&T Mail, and EasyLink (C). Though this system appears awkward, it ensures that your data will arrive in the correct format, since DASnet will translate your message to the proprietary formats of each carrier.

AT&T Mail and Dialcom, however, are the first domestic public carriers to share a live X.400 link (B)—without a doubt, the connection with the greatest potential. By adhering to a standard address format, messages can travel between different e-mail carriers. Assuming that all of the major carriers ultimately sign operating agreements with one another, it will be possible for carriers to exchange messages without actually sharing a physical link. Files will be routed through other services, and still arrive at the correct destination.



## Key

- Basic connections
- Translation
- Proprietary
- X.400 Link

# Diskette Labels for Laser Printers



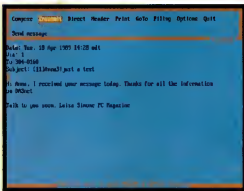
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## COMMUNICATIONS ELECTRONIC MAIL



Look at DASnet for interoffice communications. It functions as a clearing house for electronic mail by translating among proprietary formats and retransmitting the message. Here, the MCI address line is used with Lotus Express to send the message to DASnet.

ple who have a pressing need to communicate across networks today. DASnet (DA Systems, Campbell, Calif.; (408) 559-7434) has clients that range from other electronic networks (like Connect Professional Information Network, INET, or UNISON) to businesses to individuals. In turn, DASnet subscribes to most of the major carriers. DASnet translates messages from one carrier's format to another's and transmits the file.

Fees for individual users include \$33.50 to register, \$4.75 for monthly maintenance, and per-message charges. To send a 2,000-character message to MCI via DASnet, for example, will cost approximately 64¢. DASnet requires that you maintain a primary mailbox on a true e-mail system, like MCI Mail. In addition, you pay for messages both sent to and received from the e-mail services to which you do not subscribe.

### NOT JUST ELECTRONIC

While e-mail subscribers may find it difficult or costly to communicate with people on other carriers, it's a snap to send messages to people who don't subscribe to any e-mail service at all.

What starts off as an electronic file on your computer can, via the services of AT&T Mail, MCI Mail, or EasyLink, arrive at its destination as a priority letter, a Mailgram or courier delivery, a telex, or a fax. Converting electronic messages to other formats has proven to be the easiest way to sidestep the interconnectivity problems between services.

Of course, you can accomplish PC-to-fax deliveries much more directly by pur-

chasing a fax board for your computer (see "PC to Paper: Fax Grows Up," *PC Magazine*, April 11, 1989). But electronic-mail services add a certain element of convenience. You don't have to learn how to use the fax board, and you don't have to wait for the telephone connection. The e-mail service will try a connection several times before reporting back to you that the message could not be delivered.

Xpedit Systems (Eatontown, N.J.; (800) 227-9379) believes that many businesses care less about e-mail than they do about fax. *PC Xpedit* and *FAXCast* are proprietary programs that allow you to route your ASCII, *WordPerfect*, *Microsoft Word*, *WordStar*, *MultiMate*, and *DisplayWrite* documents through the Xpedit system to any fax machine worldwide. Subscribing to Xpedit means that you don't have to own an electronic mailbox or a fax board.

The Xpedit service can not only send faxes—it can also convert fax transmissions and deliver them to subscribers as electronic files using a TIFF format. The TIFF format has limited use: you can't convert a TIFF file into an editable file format, and it does take up a lot of disk space. But you can view the file on-screen to decide if you want to print it out or delete it.

Xpedit charges \$49 for the basic PC Xpedit software and \$25 for the broadcasting supplement that assists users in creating and maintaining large mailing lists. Subscribers pay a \$10 minimum monthly usage charge and are billed for the transmission time of each fax. A single-page fax transmission can cost \$.20 to \$.30.

AT&T Mail lets you choose to have all

See special offer below.

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Description	Time	Cost
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• Check 10 stock quotes	0:05	.92
• Read today's news	0:10	1.00
• Play Stellar Emperor	0:30	3.00

Total hrs. non-prime/  
1200 baud

2:00  
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## CompuServe<sup>®</sup> Monthly Summary

A summary of your monthly charges:

Item	Hours	Cost
-Download 3 Files	1:00	12.50
-Read messages on 2 bulletin boards	0:15	3.13
-Check 10 stock quotes	0:05	1.24*
-Read today's news	0:10	2.08
-Play MegaWars III	0:30	6.25

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1200 baud

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of your electronic mail delivered automatically to your fax machine instead of your mailbox. You can also call AT&T's Mail Talk service from a Touch-tone phone and listen while an electronic voice "reads" your electronic messages. Your networked e-mail system can now also have this capability via VoxMail (\$3,495 from VoxLink Corp., Nashville, Tenn.; (615) 331-0275). VoxMail is software that works with e-mail software running on a Novell MHS system; like AT&T Mail Talk, it converts electronic messages to the synthetically spoken word.

Converting fax formats to TIFF files or translating electronic text files to voice messages are conveniences that have practical business applications. There is, however, a much more powerful conversion tool connected with electronic mail. EDI, or Electronic Document Interchange, is a general term that applies to a set of protocols (X.12, for example). These protocols provide mechanisms by which the information that's entered in a standard form on one end of the e-mail transaction can be

**Certainly the main reason to use an e-mail service remains the transmission of ordinary text messages.**

translated and processed automatically on the receiving end.

Think of it as computer-to-computer communication rather than person-to-person messaging. The most typical application involves automatically converting the on-line order-entry form of the sender into a format compatible with the inventory control system of the recipient. In this example, electronic messaging becomes a mere transport mechanism for the real application—inventory control.

#### PLAIN-JANE MESSAGES

Certainly the main reason to subscribe to an electronic-mail service remains the transmission of run-of-the-mill text messages. With different carriers offering fea-

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## TRIMMING THE E-MAIL TAB

Using electronic mail efficiently means getting your message out as quickly and as cheaply as possible. Obviously, unless you're absolutely desperate, you shouldn't send a 20-page telex — and at nearly \$60, you certainly shouldn't send it on AT&T.

But before you take all of these numbers at face value, take a moment to examine the nuances that can influence price. AT&T Mail, for example, seems to be much more expensive than either MCI Mail or EasyLink when delivering short electronic memos. If you use AT&T Mail Access Plus to create your memo, however, you avoid the on-line creation charge of \$ 25, dropping the price down to \$ 35 — right in there with EasyLink. And Western Union's low, low telex charge of \$ 36 per telex minute assumes you are communicating with another Western

Union terminal. Send that same message to an "off-net" terminal and the price jumps to \$ 88 per telex minute. In addition, your testing script assumes that you will always be calling from a local number. Toll-free 800 numbers are features of MCI Mail and AT&T Mail that can keep costs down.

Take a good look at your actual usage. Alternative pricing structures are available for high- and, believe it or not, low-volume users.

Finally, consider the delivery method you use most often. While MCI Mail, for instance, may be the right choice for fax delivery, a dedicated fax-processing service like Xpedite Inc. or a PC fax board may be the ultimate low-cost solution for electronically generated messages.

### PUBLIC E-MAIL: COMPARISON OF COSTS

	Send a Report	Send a Memo
AT&T Mail (a)	\$ 3.65	\$ 0.60
MCI Mail	\$ 4.00	\$ 0.45
Western Union's EasyLink (b)	\$ 2.33	\$ 0.35
AT&T Telex	\$58.83	\$ 1.20
MCI Telex	\$34.38	\$ 0.55
Western Union's EasyLink Telex	\$22.50	\$ 0.36(d)
AT&T Fax	\$16.60	\$ 0.80
MCI Fax	\$12.20	\$ 0.50
Western Union's EasyLink Fax	\$14.20	\$ 0.55
AT&T Overnight	\$10.35	\$ 7.70
MCI Courier Overnight	\$ 9.00	\$14.00
Western Union's EasyLink Mailgram (c)	\$23.95	\$ 3.95
Federal Express	\$15.00	\$15.00

(a) Includes on-line message creation charges. Charges do not apply to users of AT&T Mail Access Plus, X.400 systems, or AT&T/PMX StarMail.

(b) These rates assume that you are communicating at 1,200 bits per second.

(c) Western Union's Mailgrams are the only overnight paper-mail delivery option with EasyLink.

(d) This price refers to Western Union's telex terminals only. If you send an "off-net" telex, the cost is \$ 88 per telex minute.

Rates in this table are based upon the following assumptions: The **Memo** is 50 words long, 250 characters typed on-line in 2 minutes. The **Report** is 20 pages, 5,000 words, 25,000 characters, uploaded in 5 minutes and 45 seconds. The user is calling from a local number. (Annual rates are not included.)

Telex transmissions are billed per telex minute, based on the output time to the receiving telex terminal. For the purposes of this comparison, we are estimating 400 characters per telex minute.

Fax prices are for domestic transmission.

tures that often parallel one another and with interconnectivity becoming a reality, customers will make their judgments on the basis of price and support.

EasyLink's recent adoption of a per-message billing puts its fee structure on a par with those of MCI Mail and AT&T Mail. Even so, there does seem to be some differentiation among the three carriers at the extremes of either low- or high-volume pricing.

Support is increasingly a matter of improving the user interface—off-line as well as on-line. Many companies have developed proprietary software to augment the on-line prompt and to help users get the most out of their e-mail systems.

This doesn't apply to just the public carriers. Both The Source and CompuServe as well as EasyLink, MCI Mail, and AT&T Mail can be accessed more efficiently with special software. Indeed, part

**E-mail service support  
is increasingly  
becoming a matter of  
improving the user  
interface—off-line as  
well as on-line.**

of the *raison d'être* for new electronic networks like Connect ((408) 973-0110) is the *Microsoft Windows*-based software needed to access their on-line information. This is the only on-line service that lets you do things like create an e-mail message in one window while running stock market quotes in another.

Even Prodigy, IBM and Sears's on-line service (available in such metropolitan areas as New York, Boston, and Los Angeles ((914) 993-8843) relies upon a sleek and easy-to-use interface to entice new subscribers. The service provides minimal messaging capabilities and has yet to prove the value of its information and shopping services; however, a flat monthly fee of \$9.95 and no on-line charges have helped it to secure an early subscriber base of 50,000 households.

Software, whether it is *Lotus Express* for MCI Mail (*Desktop Express* for Macs),

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COMMUNICATIONS  
ELECTRONIC MAIL

*Instant Mail Manager* for EasyLink, *AT&T Mail Access Plus*, or a LAN-based mail package, shields the user from the on-line e-mail interface. This cuts down on the time users must spend accessing the system on-line; it also provides an easier, more efficient way for users to create, manage, and transmit electronic mail.

#### CHANGES BREWING

Everywhere you look, the electronic-mail market is in transition. In Europe, which has been a model of stability because the PTTs (Postal, Telephone, and Telegraph offices) are basically government-operated monopolies, everyone is waiting for 1992 and open-market competition.

Here in the United States, competing e-mail carriers live off of the idea that they can supply more subscribers than the next guy. As a result, interconnectivity between carriers has not been willingly embraced. It remains to be seen exactly how X.400 and X.500 will change that.

There are predictions that, wherever possible, individual mailboxes will migrate off centralized public networks. They will be consolidated into workgroup mailboxes residing on local area networks;

gateways will be used to access public carriers. Even the Regional Bell Operating Companies (RBOCs) are now free to get into the e-mail business on a local level. It is interesting that Telemail, long known as a corporate e-mail provider that caters to large multinational corporations, is pursuing joint venture agreements with RBOCs in order to resell its service on a local level to individual subscribers.

Change always breeds confusion. But by examining the current issues and future trends, you should be able to choose an electronic-mail service that will enable you to meet your strategic needs today—and tomorrow.

#### AT&T AT&T Mail

AT&T Mail's command structure has much in common with that of competitor MCI Mail. AT&T Mail (available for a \$30 annual fee) can Show you the mes-

sages you have received or sent; MCI lets you Scan your in-box or out-box. AT&T's Read, Send, Answer, and Forward commands do as they suggest, just as in MCI Mail.

AT&T Mail, however, provides some unique options for these basic functions. For example, you can write a standard text reply, keep it on file with AT&T, and have the system generate automatic answers to every piece of mail you receive that matches a specified Subject criteria. This is a great feature if you feel that acknowledging every message is important but don't want the tedium of composing each reply.

#### ADDED CHARGES

Writing and editing messages on-line with any e-mail service is always tedious, but AT&T also makes these activities somewhat expensive. In addition to transmission charges, there is a surcharge for on-line creation. The only way to circumvent it is to create messages off-line with *AT&T Mail Access Plus*, AT&T's \$100 proprietary communications program. Even messages uploaded from your text editor incur a penalty of \$.20 or \$.45.

If you must create messages on-line,

It takes a great performance for a disk to become a legend. Chuck Berry has what it takes. And so does PROCOMM PLUS. It gives you power and ease of use that surpasses communications software costing \$250 or more. Yet PROCOMM PLUS costs just \$89.00. Which simply means when you want communications software that gives you a great performance, you can still be good to your wallet.

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# COMMUNICATIONS ELECTRONIC MAIL



The TSR portion of **AT&T Mail Access Plus**, along with the **Personal Directory**, can reside in expanded memory. The **Personal Directory** (the topmost window) will automatically address an electronic-mail message, a fax, or a telex.

you'll appreciate that AT&T augments the usual editing commands. In addition to the likes of Delete, Copy, and Change, you will find Locate and Undo. Locate lets you search for a specific text string; Undo gets you back to where you were a minute ago so that you won't have to rekey in deleted or altered text.

The Directory and Profile commands are particularly useful. Directory lets you query the database to find a subscriber's ID. The Profile command lets you choose the menuing level (full menus, brief menus, or commands), change display defaults for things such as line length, list logos for paper deliveries, and automatically

forward your mail. In a reversal of the current attempts to have faxes delivered electronically to your PC, Profile lets you have your e-mail also forwarded to your fax machine. Profile lets you change from 1 day to up to 6 days the default on-line storage period for e-mail you have read—at no extra charge.

## FORMS/FILES OPTIONS

AT&T can extend on-line storage time past 6 days, but only for an additional fee. If you opt for Forms/Files status, you'll be able to store messages on-line indefinitely. A monthly fee of \$10 gives you 30 storage units (each unit consists of a message between 1 and 7,500 characters).

Users who subscribe to Forms/Files are allowed to generate simple forms on-line and then store them for later use; colons are used to indicate fields to be filled in later. This is a simple and convenient method that can be used for creating standard business forms, including order forms and questionnaires.

Forms/Files users can share folders and create mailing lists. Mailing lists can contain separate handling instructions for each addressee. A five-name mailing list could

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COMMUNICATIONS  
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ELECTRONIC-MAIL SERVICES: SUMMARY OF FEATURES

	AT&T AT&T Mail	MCI MCI Mail	Western Union EasyLink
<b>GENERAL CHARGES</b>			
Annual fee	\$30	\$25	N/A
Minimum monthly charge	N/A	\$10 (a)	\$25 (begins 2nd month)
<b>MESSAGE CHARGES</b>			
Per-character	●	●	●
First block	1-400 char., \$.40	1-500 char., \$.45	1-500 char., \$.35
Second block	401-7,500 char., \$.80	501-2,500 char., \$.75	501-1,000 char., \$.45
Third block	N/A	2,501-7,500 char., \$1	1,001-2,000 char., \$.60
Additional blocks	Each 7,500 char., \$.80	Each 7,500 char., \$1	Each 1,000 char., \$.75
Volume discounts on monthly usage	10% on a \$2,000 minimum, 20% over \$2,000 or 12.5% on \$8,000 minimum, 25% over \$8,000	10% over \$1,000	5% over \$5,000, 10% over \$10,000, 15% over \$15,000, 25% over \$25,000
Off-peak discounts	○	○	● (20%)
COD delivery available	●	○	●
Toll-free mailboxes available	●	●	●
800 number available (surcharge)	● (None)	● (None)	● (\$.15/connect, \$.15/min.)
Local numbers/toll-free available	○/○	●/●	●/●
Foreign access	●	●	●
Via local packet-switching networks	●	●	●
Via Tymnet	○	●	●
Permanent Storage	●	○	○
<b>BASIC FEATURES</b>			
On-line user interface	Menu, command	Menu, command	Menu, command
On-line editing	●	●	●
Search/replace	●	○	○
Block changes (e.g., move, delete)	●	● (Advanced service only)	○
On-line help available	●	●	●
Proprietary e-mail links	None	CompuServe's EasyPlex, Missive (France)	MercuryLink 7500 (UK), Missive (France)
Standard (x.400) e-mail links	Dialcom, Telecom Canada, Telemail, Transpac Atlas 400 (France), KDD Messavia (Japan), TolDe 400 (Sweden), MPS400 (Australia), Dacom (Korea), Mailnet 400 and ELISA (Finland)	PT Postel (Italy)	None
On-line mail storage period			
Inbound unread	Unlimited	Unlimited	10 days, automatic mailgram

N/A—Not applicable; service does not offer this feature.

●—Yes ○—No

(a) Alternative billing entitles subscriber to up to 40 electronic messages or domestic taxes.

CONTINUES



# ELECTRONIC-MAIL SERVICES: SUMMARY OF FEATURES

	AT&T AT&T Mail	MCI MCI Mail	Western Union EasyLink
Inbound read	1 day (default), 16 days (user defined)	1 day (basic), 5 days (advanced)	5 days
Outbound sent	1 day (default), 1-6 days (user defined)	1 day (basic), 5 days (advanced)	5 days
Outbound unsent	1-6 days (user defined)	1 day (basic), 5 days (advanced)	0 days
Notification of mailbox traffic	●	●	○
Mail can be addressed via name	●	●	○
Correspondent's ID number required	○	○	●
Max. addressees per e-mail message	Unlimited	1,000	999
Max. addressees per hard copy message	Unlimited	1,000	999
Include text of mail in other mail	○	●	○
Automatic text acknowledgments	●	○	○
On-line database services/charge	○	● Dow Jones News Retrieval \$2.75/min. (b)	● Info Master, \$15 min.; \$8 search fee; FYI, \$1.60-4.80/min.
Bulletin-board capability/fees	○	● \$25 monthly maintenance, \$.30 access fee	● \$50 setup fee, \$5/month per topic maintenance, \$.50 access fee
<b>ADVANCED FEATURES</b>			
Telephone notification of urgent message	○	● \$1/message	○
Multiple mailing lists stored	● (c)	●	●
Lists can be shared among many users	● \$1.50/month	●	●
Max. letterheads or signatures stored on-line	3, \$12/yr.	1, basic; 15, advanced, \$20/yr.	1 per user
On-line forms available	● (c)	● \$25/month for 10 scripts	○
EDI support (i.e., x.12 protocol)	●	○	●
<b>SOFTWARE</b>			
Foreground mode, on-line	●	○	●
Background mode	●	●	○ (d)
TSR mode	●	●	○ (e)
Allows attachments of binary files	●	●	●
<b>GATEWAYS SUPPORTED</b>			
LAN e-mail gateways	AT&T PMX/STARMail, AT&T Gateway400	3PLUS Reach/MCI for 3Com, Network Courier, V-Bridge for Banyan	cc:Mail
Mainframe e-mail gateways	IBM PROFS, AT&T Mail Exchange (f)	IBM PROFS, DEC All-in-One, DEC VMS Mail, Gateway 3000/HP Desk, Wang Office	IBM PROFS, DEC All-in-One, Wang VS, DISOSS

●—Yes ○—No

(b) Rates are bps and time sensitive; this rate reflects peak East Coast time of 6 a.m.-6 p.m. and transmission speeds of 1,200 bps.

(c) Feature available to forms/files subscribers only.

(d) Unattended mode cannot operate in background.

(e) Office Access for the PC can be configured to be run as a TSR.

(f) AT&T Mail Exchange links with Wang Office, Wang VS, IBM PROFS, HP, DEC All-in-One.





# ELECTRONIC-MAIL SERVICES: SUMMARY OF FEATURES

	AT&T AT&T Mail	MCI MCI Mail	Western Union EasyLink
<b>TRANSMISSIONS</b>			
Rates supported (bps)	300-2,400	300-2,400	50-9,600
Can send/receive binary files directly	●	○	●
Error-correcting protocols			
X.25	○	●	●
Xmodem	●	○	●
MNP	○	●	●
Proprietary	● Y-Modem 251	○	● FAST
<b>DELIVERY AND HANDLING</b>			
Receipt of electronic delivery	● \$.40	● \$.25	● \$.25
Levels of priority marking	1	2	1
Paper mail, outbound	●	●	●
Domestic	1-7,500 char., \$2; each add. 7,500 char., \$.80	First 3 pgs., \$2; each add. 3 pgs., \$1	First pg., \$1.50; each add. pg., \$1.50
International	Variable	First 3 pgs., \$.55; each add. 3 pgs., \$1	Variable (g)
Courier delivery, outbound	●	●	○
Domestic speed/cost	Overnight: 1-7,500 char., \$.75; Urgent (4 hrs.): 1-7,500 char., \$.27.50; add. 7,500 char., \$.80	Overnight: first 6 pgs., \$.6; each add. 3 pgs., \$1	N/A
International speed/cost	Variable by destination, speed	Variable by destination, speed	N/A
Mailgram delivery	N/A	N/A	●
Domestic	N/A	N/A	First 1/2 pg., \$.35; each add. pg., \$.50
International	N/A	N/A	First 1/2 pg., \$.65; each add. 1/2 pg., \$.7
Telegram delivery (per 6-char. word)	N/A	N/A	\$4.25 plus \$.10/word
Cablegram delivery	N/A	N/A	Variable by destination
Telex, any inbound	●	●	●
Telex, outbound (per telex minute)			
Domestic	\$.95	\$.55	\$.55
International	Variable	Variable	Variable
Group 3 fax, outbound			
Domestic (first 1/2 pg., add. 1/2 pg.)	\$.55/\$.40	\$.50/\$.30	\$.55/\$.35
International	Variable	Variable	Variable
<b>SECURITY</b>			
Encrypts stored passwords	●	●	○
Restrictions available on database services	N/A	●	●

●—Yes ○—No

N/A—Not applicable; service does not offer this feature.

(g) Letter telegrams are available for foreign correspondence at 80% of the cost of cablegrams.

ENDS

## E-MAIL AS AN INFORMATION-SERVICE EXTRA

by Luisa Simone

When you log on to dedicated e-mail services like MCI Mail, EasyLink, and AT&T Mail, usually you already know the party at the receiving end of your message. While these services speed up your communication and even offer the assistance of public directories, they won't automatically introduce you to new correspondents or help you develop contacts.

But information services like CompuServe (with its offshoot PC Mag-Net), The Source, Delphi, and GENie can help you prospect for electronic-mail correspondents. Of course, these services are in business mainly to give subscribers access to dozens or even hundreds of on-line databases covering a variety of business, general-interest,

and financial topics. Whether stored directly or available through a gateway connection, the AP Wire, BRS (Bibliographic Retrieval Service), Dow Jones News/Retrieval, Dialog, or the OAG (Official Airline Guide) are available for users to browse at their leisure. Subscribers will also find that they can conveniently trade stocks, buy consumer products, and book airline and hotel reservations on-line.

These services also provide bulletin boards and open forum discussions. These open discussions can play a key role in forming new personal and professional contacts. In fact, many people come to use the e-mail functions automatically provided with these information services only after participating in on-line open conversations.

Information services like CompuServe, The Source, Delphi, and GENie not only offer access to databases and bulletin boards, their open discussions and e-mail facilities also let you make valuable new contacts.



### GENERAL SERVICES: COST COMPARISON TABLE

Dedicated e-mail carriers like MCI Mail bill on a per-message charge, but CompuServe, Delphi, The Source, and GENie charge for on-line time. Maneuvering through the menus, writing messages on-line, uploading long files, and creating mailing lists all incur charges for the time you are connected to the system.

Service	Membership Fee	Monthly Fee	Basic On-line Rate
CompuServe	\$39.95 (incl. \$25 credit)	\$1.50	300 bps, \$6/hour; 1,200/2,400 bps, \$12.50/hour
Delphi	\$49.95 (incl. \$14.40 credit)	N/A*	Peak: \$17.20/hour. Off-peak: \$7.20/hour
GENie	\$29.95	N/A†	Peak: \$18/hour. Off-peak: 300 bps, \$5/hour; 1,200 bps, \$6/hour; 2,400 bps, \$10/hour
The Source	\$29.95	\$10 (minimum usage)	300 bps, \$.36/minute; 1,200 bps, \$.43/minute; 2,400 bps, \$.46/minute

N/A\* —Not applicable: uses alternative billing method. The Advantage rate of \$24 minimum monthly usage entitles the subscriber to lower hourly rates.

N/A† —Not applicable: doesn't have a monthly fee.

### FRIENDS BY FORUM

The open forum is a unique form of electronic communication that allows subscribers to address open-ended questions to no one in particular. Various referred to by such terms as forums, sigs, and round tables, these on-line meetings are organized according to topic. Choose among subjects like computer hardware, financial advice, entertainment, or education to find other people who share either your interests or information needs.

When you post a query, it is common for another subscriber to respond publicly. Subscribers, however, do have the option of sending e-mail messages to one another's private mailboxes. CompuServe helpfully includes your EasyPlex mailbox ID number along with any questions or comments you make in a forum.

In addition to helping you prospect for potential pen pals or possible business contacts, CompuServe, GENie, The Source, and Delphi are currently in the process of enhancing the e-mail functions they provide to their subscribers. For example, all of these companies now provide access to both fax and telex deliveries to their customers.

GEIE (301) 340-4000), with the addition of its \$2 Quik-gram, can deliver paper mail to nonsubscribers. The Source ((703) 734-7500) has an unusual feature that allows users not only to send fax transmissions but also to have the return fax intercepted and delivered to a subscriber's mailbox in electronic bit-map form. Both CompuServe ((614) 457-8600) and The Source can handle binary files, and CompuServe offers separate services—InfoPlex and CompuServe EDI—that include features attractive to corporations, like gateways to PROFS- and MHS-capable LANs, on-line forms, and EDI (Electronic Document Interchange). Delphi ((800) 544-4005), for a small surcharge, will even translate your message into a foreign language.

#### BIG NUMBERS

These services can also challenge dedicated e-mail vendors with impressive subscriber figures. CompuServe gives users access to over 450,000 EasyPlex and InfoPlex mailboxes. In addition, CompuServe subscribers can gateway back and forth to MCI's 100,000 active mailboxes. On GEIE, users will find that they have access to both the internal GEMail system and GE Quik-Comm user base—the two services together totaling well over 150,000 users. The Source and Delphi both approach the 100,000 mark.

Of course, nothing's perfect. When your e-mail traffic picks up in volume, you may find the storage capabilities, mailing list support, and fee structure offered by dedicated mail carriers to be superior. Dedicated e-mail carriers bill on a per-message charge, unlike CompuServe, Delphi, The Source, and GEIE, which charge for on-line time. Maneuvering through the menus, writing messages on-line, uploading long files, and creating mailing lists all incur charges for the time you are connected to the system. Although the one-time membership fee is certainly reasonable for all of the services (see "General Services: Cost Comparison Table" at left), you may find that on-line prices that range from about \$5 to nearly \$20 an hour do not make for a cost-effective e-mail system. ■

make use of every delivery option: electronic delivery, U.S. Mail, courier delivery of hard copy, telex, and fax. On a par with MCI Mail and EasyLink, AT&T Mail offers priority handling that includes receipts and CODs on e-mail, and overnight or urgent handling for paper mail. AT&T Mail has a unique delivery option that lets subscribers temporarily without access to a modem retrieve messages via voice mail (AT&T Talk, at \$.50 per minute) from any Touch-tone phone.

#### ENHANCED ACCESS

AT&T Mail Access Plus delivers all the functionality of the AT&T Mail service and more. The big improvements over an on-line session are obvious: you get full-screen instead of line editing, commands mapped to function keys, and, as mentioned, no message-creation charge. A single keystroke gets you back on-line.

Access Plus runs in foreground or background mode, or as a TSR. Version 2.04 takes advantage of LIM 4.0 to the extent that the TSR portion of the program and the accompanying Personal Directory can reside in expanded memory and require only 25K of conventional RAM. The Personal Directory is a real bonus, enabling you to paste e-mail IDs, postal addresses, telex, and fax numbers into your AT&T document. You can also use the auto-dialer to place voice calls.

With Access Plus, sending binary files is easy. While you can directly transmit binary files with the AT&T Mail service alone, Plus can send them in background mode, so you don't have to waste time watching control characters scroll by.



#### FACT FILE

##### AT&T Mail

AT&T, P.O. Box 3505, New Brunswick, NJ 08903; (800) 367-7225.

List Price: Annual fee, \$30.

Per-Message Charges: First 400 characters, \$.40; 401–7,500 characters, \$.80; each additional 7,500 characters, \$.80.

Requires: Modem-equipped IBM-compatible computer with communications software.

In Short: Special options, like AT&T Talk and on-line folder storage, are the extras that distinguish AT&T from the competition. Its commitment to X.400 link (there is a current link to Dialcom) and volume discounts place AT&T Mail in a prime position to serve large companies.

CIRCLE 427 ON READER SERVICE CARD

#### SUPPORTING THE STANDARDS

The AT&T Mail service also supports EDI (Electronic Document Interchange). EDI is an umbrella term that covers a variety of standards (like X.12) that enable highly structured information (such as order entry forms) to be processed automatically on the receiving end.

AT&T has distinguished itself as the first public e-mail carrier to go live with an X.400 link; currently Dialcom, Telecom Canada, and several international systems are communicating with AT&T Mail using this standard. AT&T's continuing support of X.400 is reflected in its recently announced AT&T Mail Gateway400 service, which promises a transparent link to MHS X.400 systems.

It is unfortunate that features rank as only the second reason to subscribe to an e-mail service, connections to your business associates being the first. While AT&T Mail offers a host of valuable options, as of 1988 it showed only 40,000 active mailboxes. In the long run, unless AT&T Mail can deliver a large enough general subscriber base, it is more useful as an intra-company wide-area e-mail system.

#### MCI

### MCI Mail

MCI Mail delivers all of the e-mail features users have come to expect. The default command-line interface waits for you to type in your request; English-language commands like Scan Inbox, Edit Envelope, or Send do the obvious. Standard handling options let you indicate how the message should be delivered simply by adding a comment in parentheses after the addressee's name—(Telex), for example.

By adding (EMS) to that same field, MCI delivers something more. This command allows you to send messages to users linked to other e-mail services, including Italy's PT Postel, France's Missive, and, most notably, the 450,000 active mailboxes on CompuServe.

#### PAST MCI SERVICES

In the past, MCI Mail's Advanced and Basic services were differentiated by price and features. Either service is now available for an annual fee of \$25, or a minimum monthly usage charge of \$10. The latter entitles you to 40 electronic messages or domestic faxes—after that, the

Businesses come in all shapes, sizes, and locations, and they each have different communication needs. If your company's top priority is communication among its divisions, alternatives to public e-mail services like MCI Mail, AT&T Mail, and EasyLink are worth considering.

The big surprise is that these alternatives don't require that you install a LAN (never a hassle-free proposition) or swallow the substantial cost of buying a mainframe. Services like Dialcom, Telemail, GE Quik-Comm, Notice, Connect, and OnType offer all of the functionality of networked e-mail without the need to own hardware more complicated than a modem.

The network analogy is very appropriate: these services, known as value-added networks, cater to group needs. The rules, and the rates, seem to indicate that individuals need not apply. Most of these services require that a new client sign on with a minimum number of nodes (users). The complicated pricing structures usually include a basic charge (a one-time subscription fee or a minimum monthly fee), charges for on-line time, charges based on the number of characters in a file, and charges for discretionary storage. Notice (213) 615-0311, for example, has a \$500 minimum monthly usage charge per client organization. Telemail ((800) Telenet) charges \$14 per hour per client for prime-time connection. Even Quik-Comm ((301) 340-4000), which charges on a per-message basis, adds a \$.50 surcharge for interzone messages and a \$.20 surcharge for intercommunity messages.

While there are volume discounts, for most individual users the costs are prohibitive. GE Quik-Comm, Notice,

## CORPORATE E-MAIL SERVICES: Another Kind of Network

by Lulus Simone

and OnType ((800)435-8880) all state clearly that they serve large companies; although size is not the ultimate determinant, the Fortune 1,000 constitute a sizable percentage of their clients. Dialcom ((301) 881-9020) and Telemail are changing their "corporations only" policies by introducing alternative pricing schemes for individual subscribers.

But individual subscribers may find that, quite simply, they are alone. Much like a network, corporate clients tend to communicate within workgroups, sometimes failing to message people outside of the company. Companies have been known to keep mailbox numbers unlisted and employees on totally private systems, effectively making them inaccessible to other subscribers. Although recent X.400 gate-

ways to MCI Mail and AT&T Mail can be useful, Dialcom and Telemail have yet to prove that they can provide real benefits for single users.

### SUBSCRIBER BASES

Inaccessible mailboxes are one reason that subscriber figures can be misleading. These figures are also difficult to pin down because so much of the traffic is international. Dialcom claims to have 140,000 domestic mailboxes and an equal number of foreign subscribers. Telemail's total subscriber base may be as high as 300,000—with nearly 200,000 domestic users. OnType and Quik-Comm both have between 50,000 and 100,000 users; no figures are available for Notice.

Large foreign-subscriber figures testify to the emphasis placed on global communication—another indication that many of these services' clients are not merely businesses, but big business. OnType, Notice, Dialcom, GE Quik-Comm, Connect ((408) 973-0110), and Telemail all operate in up to 30 foreign countries, making global electronic transmission transparent. Dialcom is actually owned by British Telecom, and the PTT (Postal, Telephone, and Telegraph offices) of Germany, France, Spain, Belgium, Holland, Scandinavia, Australia, and Singapore are Notice shareholders.

### SOME COMMON BONDS

Because national and multinational corporations have many of the same needs as individual e-mail users, corporate e-mail vendors deliver functions that match EasyLink or AT&T feature for feature. They provide electronic messaging, telex capability, and fax transmission 7 days a week, 24 hours a day.

normal per-message rate (based on the number of characters) applies. This kind of flexible billing should appeal to low-volume users.

Featurewise, only a few differences remain: Advanced users can store messages on-line for 5 days and Basic users for 24 hours; Advanced service provides the default command structure, while Basic service offers a menu interface (you can call MCI to change from the command to the

menu interface). In most other respects, the two services are functionally identical.

MCI messages can contain statements to qualify an addressee's name. This is helpful if you want to reach a Mr. Smith, for example, but don't know his first name. If you know that he works for Widget Inc., you can find him by addressing your message to "Smith/Widget". If you just address it to "Smith", MCI will scroll across your screen the full name and mail-

box address of every Smith who subscribes and prompt you to choose the correct one.

### SUBSCRIBER OPTIONS

MCI Mail offers the same delivery options as AT&T: electronic messages, paper mail, courier overnight delivery, telex, and fax. But where AT&T allows users to share resources only through so-called "private" folders, MCI Mail uses the term

## COMMUNICATIONS ELECTRONIC MAIL

Priority letters can be delivered through the U.S. Postal Service. Return receipts, binary data transfers, on-line forms, and specialized communication software are all available.

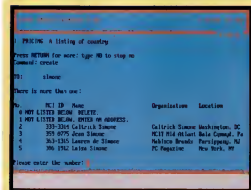
Corporate services offer a higher degree of administrative support and customization—as well as application development within the context of electronic mail—than do public e-mail systems. Quik-Comm finds, for example, that its e-mail services are increasingly used as the transport mechanism for higher-level EDI (Electronic Document Interchange) applications—like accounting, remote order entry, and inventory control. (Among these five services, Notice alone does not support EDI.) Applications that take advantage of e-mail don't always involve EDI—both Dialcom and OnTyme can create routines to search news wires and databases and can deliver the results to a user's mailbox.

While most of these capabilities are also available through public services, it remains to be seen if MCI, AT&T, and Western Union will ever supply the support and customization available with Dialcom, Quik-Comm, Notice, OnTyme, or Telemail.

Understanding the future role of corporate e-mail services seems to have inspired Quik-Comm to announce a new product, *LAN Connector*. *LAN Connector* will allow Quik-Comm to function as a wide area network, tying local PC networks together to create national and even global computing communities. Actions like this contribute to the view of corporate e-mail services as another, more extensive kind of network and foster the notion that productive workgroups can be separated by many miles and several time zones. ■

"publish" to designate how open mailing lists and on-line forms can be. The owner of a list or a form controls who has access to it, but anyone can use the Find command to discover what's available. A complication to this is that MCI's version of on-line forms requires you to develop the Mail Script off-line in dBASE.

Subscribers can also create bulletin boards on MCI Mail's network. For a \$25 charge per month, organizations can keep



Typing my own name (Simone) at the "To:" prompt returns a list of all of the Simones who subscribe to MCI Mail and a query. Typing the number that appears at the left of each name tells MCI Mail which Simone is the correct addressee.

their members apprised of the latest news, or businesses can provide customer support. The Dow Jones News/Retrieval database is available, but beware—the billing structure changes once you are logged on to it. Rates become time- and bps-sensitive, meaning that you pay per connected minute and that costs are higher for business hours and for faster transmission rates.

### EXPRESSING YOUR MESSAGES

If what interests you most is sending and receiving electronic mail, you should consider *Lotus Express*, a proprietary communications package developed jointly by MCI and Lotus Development Corp. It can be run either as a standalone program or as a *Lotus Metro* desktop accessory. This TSR works with Lotus-style menus, runs only in background mode, and makes communicating with MCI Mail virtually transparent. *Express* gives users a mail-management system in which folders can be created and messages stored. All of these functions take place off-line. Perhaps most important, the only way you can transfer binary files via MCI Mail is to use *Express*'s attachment feature. The \$150 package (the price includes a first-year subscription to MCI Mail) is available from Lotus ((617) 577-8500).

The biggest drawback to *Lotus Express* is that it takes up too much memory; LJM 4.0 support would be a welcome upgrade. Be sure you learn how to unload *Express* from memory—you will undoubtedly find that at least one of your favorite applications will require you to do this all the time.

### NETWORK HOOKUPS

Several third-party software vendors have announced products intended to let network users link up to MCI Mail transparently, just as *Lotus Express* does for individual users. LAN-based e-mail products with gateway services to MCI have been announced (but not shipped) by the Network Courier, The Coordinator, and Da Vinci. All of these links are proprietary to MCI Mail. Although MCI has come out in favor of the X.400 standard and has even signed an agreement with PT Postel in Italy, as of this writing there are no live X.400 links to MCI.

MCI has led the way in interconnectivity with its proprietary link to Compu-



### FACT FILE

### EDITOR'S CHOICE

#### MCI Mail

MCI, Customer Service Department 0966, 8th floor, 1150 17th St. NW, Washington DC 20036; (800) 444-6245.

**List Price:** Annual fee, \$25. (Alternative billing method available: \$10 annual minimum usage fee for up to 40 electronic messages or domestic fax messages per month.)

**Per-Message Charges:** First 500 characters, \$45; 501–2,500 characters, \$75; 2,501–7,500 characters, \$1; each additional 7,500 characters, \$1.

**Requires:** Modern-equipped IBM-compatible computer with communications software.  
**In Short:** Proprietary links to CompuServe give MCI Mail subscribers access to the largest combined e-mail user base around. The ability to access mailing lists and forms that have been "published" on-line, and new flexible rates for low-volume users, may make MCI Mail even more attractive for the individual subscriber.

CIRCLE 428 ON READER SERVICE CARD

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exclusive formulation and Mark Q Manufacturing Process, they break Murphy's Law millions of times a day. Year in and year out.

And our engineers have taken the same fanatic approach with all our

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# r Breaking y's Law.



data storage products: diskettes, data cartridge tapes, computer tapes and optical disks. So when you get

down to it, there are only two choices.

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For more information about formatted diskettes, call 1-800-888-1889, ext. 10.

**3M**

CIRCLE 267 ON READER SERVICE CARD



If your company uses an internal e-mail system on its LAN, you may eventually choose to take advantage of gateway services to access a public e-mail vendor. Gateway software lets you address a message to someone and have the network directly and automatically map the recipient's name to the correct mailbox—whether the mailbox resides on the same network, on a mainframe system, or on a public e-mail carrier.

Unfortunately, LAN-based e-mail systems are not all that easy to connect to public carriers. MCI Mail, AT&T Mail, and EasyLink are all accessible from such mainframe- or minicomputer-based systems as IBM PROFS, DISSOS, DEC All-in-1, DEC VMS Mail, Wang Office, and HP Desk. AT&T markets AT&T Mail Exchange, which runs on a dedicated minicomputer and provides gateway service between any of the internal systems and AT&T Mail.

The reason for the disparity is that mainframe and minicomputer-based e-mail systems have certain advantages over LAN-based e-mail systems. First, they have existed long enough to be well understood. Also, the protocol by which they communicate with other e-mail systems is straightforward X.25: a basic part of the OSI (Open Systems Interconnection) model, a collection of communication standards that grow in complexity as you rise through its seven levels. The X.25 protocol exists on a fairly low level.

Conversely, LAN gateways must operate on the highest level of compatibility—no mean feat. Ultimately, this seventh heaven of protocols, in the form of X.400 and X.500, will make transporting messages from internal LAN-based e-mail systems to public carriers totally transparent. But at the moment, the operative word is "ultimately." Although most LAN e-mail vendors have announced support of X.400, and one vendor—Network Courier—has even announced an X.400 product, we know of no commercially available program that runs on a LAN and delivers an X.400 gateway to a public carrier.

## GATEWAY TECHNOLOGY: So Near, Yet So Far

by Frank J. Derfler, Jr., and Luisa Simone

### HERE AND NOW

If you want gateway functions for your LAN today, you must turn to vendors who are supplying proprietary products governed by a mishmash of standards. This is a three-handed card game where network vendors, e-mail vendors, and gateway vendors must somehow all get their programs to cooperate. Banyan Systems' *VINES*, for example, takes advantage of technology like Soft-Switch's *V-Bridge* to access MCI Mail.

The problem is that most of the proprietary technology in use was original-

## Unfortunately, LAN-based e-mail systems are not all that easy to connect to public carriers.

ly developed for specific products. In addition to their roles in Action Technologies' *The Coordinator* or in *LAN Fax/10*, these technologies are being licensed to third-party vendors. ALCOM ((415) 493-3800), which makes and markets *LAN Fax/10*, licenses its technology to Da Vinci Systems Corp. *LAN Fax/10* runs on Banyan, 3Com, and Novell MHS (Message Handling System) networks. In addition to providing gateway fax transmissions, it converts your messages into a form acceptable to MCI Mail and EasyLink.

In the same way, PCC Systems ((415) 321-0430) sells modules that provide proprietary links for its LAN-based e-mail system, *cc:Mail*, to Telemail, EasyLink, CompuServe, and MCI Mail.

Both *LAN Fax/10* and *cc:Mail* include translation routines that convert their internal formats to the MHS format. MHS was developed by Action Technologies ((415) 654-4444) and can be licensed for inclusion in other prod-

ucts. Much like X.400, MHS specifies how you address an electronic envelope on the network or across networks. It became a standard when Novell adopted it as the protocol for addressing and transporting messages on its networks.

### LET'S GET COMPATIBLE

The benefits of MHS coupled with Novell's endorsement have inspired other companies to get compatible. Ashton-Tate is now licensing the MHS technology for *Framework III*. On the receiving end, AT&T Mail has announced Gateway 400, which can accept messages from any X.400 or MHS network.

Other products that can communicate with MHS include Higgins electronic mail, On-Site Information Services' *M-Bridge to MCI Mail*, Informix Software's *SmartWare* database, and VOXLink's *Voxmail* voice synthesis software for networked e-mail systems.

Action Technologies admits that the MHS standard provides only about 90 percent of the functionality inherent in X.400, but the standard has some here-and-now benefits that cannot be denied. Software developers have found it difficult to implement X.400 because DOS's memory constraints make it impossible to keep the entire OSI model in memory. In addition, most of the gateway products discussed here cost between \$700 and \$1,500. Establishing and maintaining X.400 links will probably cost three to four times as much.

It is easy to predict a scenario in which MHS becomes the gateway solution for small or low-cost LAN installations. Certainly it is possible to imagine an X.400 translation from MHS's proprietary format—it really would be no different from the current translations from MHS to MCI Mail or AT&T's format. In the final analysis, both MHS and X.400 will increase the speed at which individual mailboxes migrate off the public networks and onto LAN-based e-mail systems. ■

*Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine.*

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Grade  
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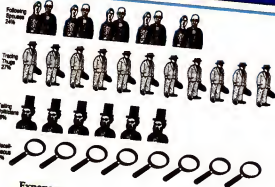
Vegetables

ming  
Management  
Management

## Ginsberg Investigations Detective Agency

### Income Breakdown By Percent

Year End Review



### Expenses

Equipment  
Magnifying glasses  
Cigarettes  
Wire tap gadgets  
Secret decoder ring  
Shoe phone  
Hospitalization

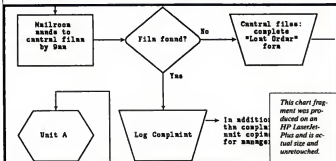
Expense Account  
Staying in sleazy hotels  
Paying for busted-up  
hotel rooms  
Whistling lessons  
Scriptwriters for TV pilot  
Cab fare

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CIRCLE 196 ON READER SERVICE CARD



An on-screen chart processor that knows about charts and diagrams, not just another "screen-draw" program that makes you do most of the work. EasyFlow is a powerful full-screen graphics program dedicated to data-flow diagrams, flow charts and organization charts. With it you can quickly compose diagrams. More important, you can easily modify them so they are always up to date.



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**Fast.** Written in assembly language for speed.

**Large.** Diagram size limited only by available memory. Supports LIM expanded memory. Diagram too large for your printer? EasyFlow automatically breaks the diagram up & prints it in page size pieces.

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**It prints.** On most popular printers including IBM, Epson, Toshiba, HP LaserJet, HP Desk Jet XEROX 4045, postscript printers and many others.

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**Documented:** 130 page manual plus over 150 screens of context sensitive help.

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Thousand Island Park, NY 13692



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Information: (613) 544-8035 ext.49  
Telefax(G3): (613) 544-9632

## COMMUNICATIONS ELECTRONIC MAIL

Serve. But now it must act on X.400 links with domestic vendors or risk losing its leadership position. When you consider that MCI and AT&T Mail deliver easy-to-use services, and that EasyLink (with 175,000 active mailboxes in 1988) and MCI (with 100,000 active mailboxes as of last year, plus access to CompuServe users) deliver the largest subscriber bases, a conclusion is easy to reach. MCI remains the winner for individuals seeking e-mail capabilities—at the moment.

## WESTERN UNION TELEGRAPH CORP.

### EasyLink

Strictly on the basis of numbers, Western Union Telegraph Corp.'s EasyLink provides tough competition for MCI Mail and AT&T Mail. EasyLink offers a greater number of delivery methods: in addition to electronic delivery, you can opt for U.S. Mail service (2-day delivery), mailgram, telegram, cablegram, telex, and fax transmissions. Subscriber numbers are impressive, too—EasyLink surpasses MCI Mail's subscriber base with approximately 175,000 active mailboxes. But the real news about EasyLink concerns the numbers that appear on the bills.

In May of this year, Western Union announced a new pricing structure for basic EasyLink service. Users will no longer be billed for time spent on-line, nor will they have to pay a surcharge for using high-speed phone lines. Like MCI Mail and

## PC MAGAZINE FACT FILE

**EasyLink**  
Western Union Telegraph Corp., 1 Lake St.,  
Upper Saddle River, NJ 07458, (201) 818-5000

**List Price:** Minimum monthly charge, \$25.

**Per-Message Charge:** First 500 characters, \$35; 501-1,000 characters, \$45; 1,001-2,000 characters, \$60; each additional 1,000 characters, \$375.

**Requires:** Modern-equipped IBM-compatible computer with communications software.

In Short: EasyLink from Western Union offers a large subscriber base, a variety of delivery options, extensive database services, and new lower prices. But the actual experience of creating, storing, or editing messages on-line can be frustrating for the average PC user.

CIRCLE 426 ON READER SERVICE CARD

# The PERFECT LAN FRONT-END!

## Meet Perfect Menu. The Perfect LAN Front-End.

(Complete with E-Mail!)

Menu Program, System Administrator, Electronic Mail System, Usage/Project Tracker, Security Watchdog, and much more, all in one program for your DOS LAN or stand-alone.

Perfect Menu is a total LAN Front-end solution—compatible with ALL DOS LANs (Novell, 3COM, PC-MOS, Network-OS, Banyan, you name it). For all its power, **Perfect Menu** is **completely Non-Memory Resident**, and self-installs across any network, to any local, redirected and virtual drive of any size.

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#### ◆ LAN PAK/UNLIMITED Users Per File Server.

If you're looking for best value in network front-end, menu, E-mail, usage/project tracking, security and productivity software—then this is the perfect selection! Easy to setup, administer and use, yet completely customizable and extremely powerful and sophisticated. It's simply perfect.

Retail Price: \$349.95

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If you have a PC-based network or applications, then our five user version sets the standard for small networks! Not only is it easy-to-use, it's easy-to-administer and has all the power of its Unlimited Big Brother. Of course, if you have growth in mind, all versions are fully upgradeable.

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#### ◆ BUSINESS PAK/Stand-alone.

With our single user BUSINESS PAK, many users share one stand-alone computer. You can have all the power of the PERFECT MENU network versions as you administer productivity—not headaches!

Retail Price: \$84.95

#### ◆ BASIC SYSTEM/Single User.

Want perfection at home? PERFECT MENU BASIC SYSTEM is as powerful as it is easy to use. At a \$49.95 suggested retail, it's one of the best values in its class.



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CIRCLE 513 ON READER SERVICE CARD

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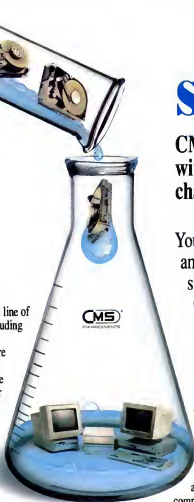
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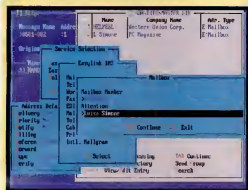


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Office Access for the PC gives EasyLink a new look off-line. The pop-up windows make functions accessible from anywhere and also prompt the user for the right input. Here one window displays available delivery options and the default settings for the current addressee.

AT&T, EasyLink now bills according to the number and length of the messages sent.

Under the old rate structure, our sample report and memo (see the chart "Public E-Mail: Comparison of Costs" in the sidebar "Trimming The E-Mail Tab") would have cost \$3.08 and \$1.20 to transmit electronically. Providing you are transmitting at 1,200 bits per second or faster (anyone transmitting at 300 bps will incur a surcharge), those figures drop to \$2.33 and \$3.35, giving EasyLink the appearance of being the cheapest of the three services included in the survey.

Appearances can be deceiving, though: niggling holdovers from the old pricing structure—like a \$25 minimum monthly charge and surcharges for the use of 800 numbers—add to the real-life cost of using EasyLink.

A new full-service offering does roll some additional functions into the basic subscription price. You can now scan your mailbox, read mail, and check the status of outgoing messages without incurring any additional charges.

#### FACING FRUSTRATIONS

The EasyLink default on-line user interface is frustrating. Nonmnemonic or arbitrary commands like PTS (proceed to select), GA (go ahead), and LLLL (signaling the end of a message), make EasyLink anything but easy for novices. Fortunately, you can bring up a menu system with common English terms like scan or read.

Except for the ability to write over a character (provided you are still on the same line), EasyLink offers no on-line

editing. Worse, if you are on-line and don't wish to send a message immediately, be prepared to lose your draft because EasyLink cannot store it on-line. The only workaround (other than creating messages off-line) is to send the message to yourself. Once it is delivered to you as mail, you can store it for 5 days.



#### EDITOR'S CHOICE

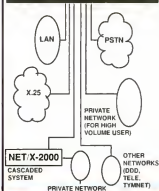
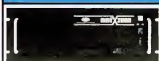
• MCI Mail

A large subscriber base, access to CompuServe EasyPlex and InfoPlex mailboxes, straightforward on-line commands, and alternative pricing schemes for low-volume users make MCI Mail the best choice for individual and small companies.

Midsized and larger companies, however, may want to consider AT&T Mail. High-end features like EDI, on-line forms generation, shared folders, and the first working X.400 link to another domestic carrier (Dialcom) can provide functionality not currently available with MCI.

Of the three carriers, Western Union Telegraph's EasyLink maintains the largest internal subscriber base. And, in addition to a wide variety of information services, EasyLink provides many of the same e-mail functions as AT&T and MCI. EasyLink on-line, however, retains all of the quirks that *PC Magazine* found frustrating when we reviewed the product 2 years ago.

# Private E-Mail and More...



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EasyLink also requires that you know the addressee's exact mailbox number in order to send a message. The on-line user directory doesn't do much to lessen this inconvenience. To look someone up in the database—which is accessible only if you pay an additional annual \$12 fee—you must exit the mail service. The database doesn't make it particularly easy to find individuals because it is organized around company names and mailbox numbers.

One way to get around the "no name" addressing convention is to use the RediList feature. RediLists are mailing lists; they can be named and can contain from 1 to 999 mailbox numbers. While RediLists fulfill the traditional role of mailing lists—sending the same message to a number of people—anyone desperate to ad-

## Instant Mail Manager compensates for EasyLink's lack of on-line editing.

dress messages by name can establish mailing lists for individual mailboxes and title each with a person's name. It's awkward, but it works. EasyLink also allows users to assign a two-digit numerical code to frequently used destinations, such as EasyLink mailboxes, telex terminals, or fax machines. RediLists and abbreviated address codes can be created only by sending a message with your specifications to Western Union's service department.

### INSTANT COMPENSATION

Western Union's *Instant Mail Manager* (\$150) is a proprietary communications program that compensates for EasyLink's nonexistent on-line editing facilities with a word processing module that includes features like cut-and-paste and margin settings. An address list allows you to forget all about mailbox numbers and use people's names instead. A one-keystroke command initiates communications and sends messages automatically.

While unattended operation is possible with IMM, the program must run in the foreground, and you must capture the en-

tire session to a file. (The log file is the only way you know that your messages have been successfully transmitted.) Unattended operation allows you to start transmission after you've left the office—a 20 percent discount is offered on all messages sent during off-peak hours.

Western Union recently began shipping *Office Access for the PC*, a \$295 upgrade to the IMM package; the software addresses some of IMM's shortcomings. Pop-up windows allow you to respond to various prompts regarding addressing options or adding a name to your address list. You can compress and encrypt files, create electronic forms, and even shell out to a major word processor (like *WordPerfect*) to create a message. Best of all, the program allows background operation. You must still rely on log files of the session, however, to make sure that your file was transmitted correctly.

### HIGH-END ABILITIES

The EasyLink service does provide some useful high-end features. While it does not support such simple features as the creation or storage of on-line forms, it does support EDI. (If you don't buy *Office Access*, you can get the \$100 *Instant Forms Plus* to create forms off-line. *Office Access* includes the functionality of both *Instant Forms Plus* and IMM.) You also get the ability to directly transmit binary files.

Currently, Western Union's commitment to the X.400 protocol is reflected by connections to several European PTTs and by EasyLink's participation in the AIA's (Aerospace Industry Association) pilot program for X.400 connectivity.

Bulletin board capabilities and extensive database offerings round out EasyLink's services. For only \$.15 per minute, InfoMaster gives you low-cost access to over 800 independent databases. FYI News offers briefs on topics as diverse as foreign finance, flight schedules, and local sports.

EasyLink provides a host of features, including many of those found in MCI Mail and AT&T Mail. The clumsy user interface, however, makes it difficult to access those capabilities. *Instant Mail Manager* mitigates some of EasyLink's annoying flaws, and *Office Access for the PC* goes even further in this respect. If you opt for EasyLink, you'll find that one of the proprietary programs is a must. ■

*Luisa Simone is a contributing editor of PC Magazine.*



# PC BRAND Chosen<sup>#</sup> 1 For Customer Service and Support.

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**PC BRAND Chosen #1 For Customer Service and Support.**

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*-Personal Computing's 10 Best Mail Order Companies, Feb, 1989*

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**PCV20 AD-II**

**\$559**

**15 MHz Throughput in an XT. Norton SI 4.0  
512K, 360K Drive, 84-Key Board**

**Standard System Features:**

- 10MHz Nec V20 CPU with 1.5 times the power of the 8088!
- 512K RAM standard. Expandable to 640KB
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Drive Video	1 Floppy	2 Floppy	20MB	42MB-46MB 1.1 B/L	40MB-28MB 1.1 B/L
Mono	\$669	\$749	\$924	\$944	\$1077
RGB	\$819	\$899	\$1074	\$1094	\$1227
EGA	\$1024	\$1104	\$1279	\$1299	\$1432
VGA/Mono	\$859	\$939	\$1114	\$1134	\$1267

**PC BRAND 286/12 \$845**



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"Neat" Chip Set*

**12 MHz Clock, Zero Wait Operation,  
Norton SI 15.3 • Landmark™ Speed 16MHz  
512K, 1.2MB or 1.44MB Drive, 101- Keyboard**

**Standard System Features:**

- 80286-12 Processor Operating at 12MHz with Zero Wait States delivering 16MHz Effective Throughput
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- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Small foot print case with 5 Disk Drive bays

**Options:**

- Full size 5 drive case • Factory installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable
- Full or Mini Size Tower® Case

**Standard Pre-Built Configurations:**

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Drive Video	42MB-46MB 1.1 B/L	40MB-28MB 1.1 B/L	70MB-30MB 1.1 B/L	120MB-25MB 1.1 B/L	
Mono	\$1295	\$1399	\$1625	\$1809	
EGA	\$1644	\$1760	\$1985	\$2159	
VGA 16 bit	\$1759	\$1860	\$2095	\$2269	
VGA/Mono	\$1526	\$1625	\$1860	\$2034	

# Unbelievable Price

## PC BRAND 286/20 \$999



*Ideal Novell Server!*

20 MHz Clock, Zero Wait Operation  
NortonSI 20.4 • Landmark™ 25.9MHz  
512K, 1.2MB or 1.44MB Drive, 101-KeyBoard

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- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
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- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- Built-in System Board LJM 4.0 EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

### Options:

- Full or Mini Size Tower • Case • Factory Installed RAM Upgrades
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- Compact Style LCD or Plasma Portable

### Standard Pre-Built Configurations:

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Mono	\$1530	\$1730	\$1940	\$2496	\$2890
EGA	\$1885	\$2124	\$2295	\$2890	\$3245
VGA 16 bit	\$1995	\$2295	\$2405	\$3061	\$3355
VGA/Mono	\$1760	\$1960	\$2170	\$2726	\$3120

## PC BRAND 386/SX-20 \$1099



20 MHz Clock, Zero Wait Operation  
NortonSI 23.0 • Landmark™ 23.5MHz  
512K, 1.2MB or 1.44MB Drive, 101-KeyBoard

### Standard System Features:

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- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- Phoenix BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays (Shown with optional Mini Size Tower • Case)

### Options:

- Full or Mini Size Tower • Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compact Style LCD or Plasma Portable

### Standard Pre-Built Configurations:

386SX-20 w/512K, Hard Disk Drive, Monitor & Video Card					
Drives	40MB 20MB 1:1 MFM	71MB 20MB 1:1 MFM	110MB 20MB 1:1 RLL	170 10MB 1:1 ESDI	330 10MB 1:1 ESDI
Mono	\$1630	\$1830	\$2040	\$2596	\$2990
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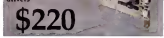
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# VGA for the BUDGET- MINDED

If VGA quality and compatibility, but not necessarily color, are what you need to outfit your system, one of these monochrome VGA displays is for you. PC Labs examines 27 single-hued models ranging from \$149 to \$389.



by Winn L. Rosch

Display technology, like fame, is sometimes earned, sometimes thrust upon you. You earn it with hard cash when you insist on the latest video standard—IBM's Video Graphics Array—when you buy or upgrade your PC. Alternatively, VGA graphics may be thrust upon you when you purchase a machine that has it packed inside as standard equipment. Either way, you face a hard decision when you want to put VGA quality on the screen of your PC: Should you connect a color or a monochrome display?

The choice may seem straightforward: either peacock-caught-in-a-paint-factory color graphics with up to 256 simultaneous colors, or monochrome graphics that can be likened to a flashlight in the coal bin. You take the former when you're

ILLUSTRATION: NESTHE LUBKE

MONITORS  
MONOCHROME VGA MONITORS

looking for spectacle, the latter when it's all you can afford. Not doubt about it, monochrome means a less expensive display.

Take one look at any of these 27 monitors PC Labs has evaluated, however, and you'll see that monochrome VGA displays are not simply for the economy-minded. At their best, their images are actually sharper than those formed by color VGA displays. While each pixel of a color image is made from a trio of three dots that tend to blur the pixel's edges, a monochrome pixel is a single, sharply defined dot of a single color. If you're concerned about quality and readability, for any application that doesn't require a full color spectrum, monochrome is both eye-pleasing and cost-effective.

In fact, the only downside to choosing a monochrome VGA display is its lack of color variety. Earlier monochrome display systems—whether they were based on IBM's Monochrome Display Adapter, the Hercules Graphics Card, or a monochrome monitor plugged into an Enhanced Graphics Adapter—sucked you with other penalties. All suffered compatibility problems with color graphics software. While the MDA could not display graphics at all, the other two adapters required applications to be specially written in order to get graphics with all points addressable on the screen. Programmers had to go to extra effort to add monochrome graphics to their products.

Monochrome and color VGA graphics, on the other hand, are virtually interchangeable. The only complication for the programmer is considering how to translate colors into black and white.

#### BETTER QUALITY AN ISSUE

Monochrome VGA displays provide better quality than any of their officially sanctioned, single-hued ancestors. You can still do better than VGA quality, but this requires a proprietary display system, which will completely undermine the cost advantage of monochrome systems.

Even the least-expensive proprietary system, the monochrome Amdek 1280 (or its identical twin, the Wyse 700), retails for \$995. Compare that with the list price of adding the least-expensive monochrome VGA display to a PC that comes with built-in VGA graphics: \$149 for the Intec 1261L.

While the Amdek/Wyse system and the even more expensive proprietary monochrome systems deliver better on-screen

quality (the Amdek/Wyse tops out at 1,280-by-960-pixel resolution), all suffer from the same problem as earlier monochrome systems. Only a limited repertoire of programs can take advantage of the top resolution of a proprietary system. As a result, most standard DOS applications run on an expensive proprietary display system with performance only equal to, if not worse than, that of a monochrome VGA system.

That's not to say that high-resolution proprietary display systems don't have their place. They're merely instances of a specialized technology that work best with specific graphics-intensive applications like desktop publishing and computer-aided design. A monochrome VGA system, rather, is your best buy as a general-purpose display tool.

At their best,  
monochrome VGA  
monitor images are  
actually sharper than  
those formed by color  
VGA displays.

#### PREMIUM HOT DOGS

Compared with color monitors, monochrome VGA displays are bargains because they're relatively simple devices. For a manufacturer, building a monochrome display takes just a little more skill than making a hot dog. Just take a tube, garnish it with a relish of electronics, slide it into its bun-come-case, and it's ready for the consumer.

Color displays are inherently more complex. Where a monochrome display requires but one electron gun to light one color of phosphor on the screen, color displays use three that must be carefully adjusted so that they converge properly. In addition, color displays require a thin shadow mask (or slot mask in some sets) between the electron guns and the screen to prevent a beam meant for one color from splashing over onto other colors. Monochrome monitors don't need such critically

aligned masks to ensure a clear image.

Fewer guns, less complex electronics to operate, and no masks keep the prices of monochrome displays low and eliminate the need to worry about such issues as dot pitch (the spacing of the holes in the shadow mask) and convergence (how far the three color beams spread from one another within a pixel).

The internal electronics and mechanical design are the critical elements that govern monochrome display quality. The bandwidth of the electronics—that is, the frequency range of signals that the display can process (usually expressed as a figure in megahertz representing the upper frequency limit)—determines the resolution limit of the display.

Some manufacturers contend that VGA displays can be less expensive to make than old-fashioned MDA monitors. Their arguments do make sense. A VGA display requires no costly digital-to-analog conversion circuitry. Display systems are essentially analog devices. MDA signals are digital, while VGA are analog—a better match.

Monochrome VGA prices are higher partly because a VGA display requires circuitry with higher frequency capabilities than an MDA display—a 31.2kHz horizontal frequency versus 18.1kHz for the MDA. A monochrome VGA display also requires about 66 percent more bandwidth than an MDA monitor. In addition, all VGA displays require extra circuitry to adjust image height to match the number of lines in the video standard being used. (Various VGA modes form images from 350, 400, or 480 lines.)

Without a doubt, monochrome VGA display prices will eventually tumble down to the level of today's MDA monitors—competition and maturing technology will ensure that. But don't expect bargains too soon; it took about 5 years for MDA displays to break the \$100 barrier. Moreover, the promise of future bargains will not do you any good when you have an immediate need.

#### DISTINGUISHED CLONES

Finding the best monochrome VGA display proved one of the toughest challenges PC Labs has ever faced, because the competition is already fierce and the products are closely matched. Describing the subtle variations among them takes a microscope and a library of thesauruses; hence the brevity of the reviews. The major differences among the 27 tested displays appear

## VGA: The Herculean Successor

by Winn L. Rosch

Before VGA, monochrome graphics meant but one thing—the Hercules Graphics adapter. Fully compatible with IBM's Monochrome Display Adapter (MDA) in displaying text, the Hercules board added graphics to the capabilities of ordinary digital monochrome displays. Along the way, it brought the highest graphics resolution available to standard PC monitors before VGA: 720 by 348 pixels.

For nearly 5 years, the Hercules card was the standard for monochrome graphics. Dozens of programs were rewritten to take advantage of its capabilities, including the one that made the Hercules card a success, *Lotus 1-2-3*. But in 1987, the introduction of the VGA standard challenged Hercules's dominance. In the long run, VGA will likely triumph as the graphics standard for both color and monochrome.

### MORE THAN A QUALITY ISSUE

Quality is not the main reason for VGA's superiority. The VGA standard's resolution improvement over Hercules is modest. Text mode is slightly sharper at 720 by 400, adding two extra vertical dots to the matrix from which each character is made. In graphics mode, the VGA system delivers 640 by 480 resolution that's about 20 percent sharper than the 720 by 348 delivered by the Hercules board—not too dramatic an improvement.

VGA, however, holds a couple of important advantages. Hercules operation is completely different from other graphics systems. It's not compatible with color graphics software; instead, the Hercules system requires different

program code or software drivers to operate.

With VGA, monochrome and color are united under a single standard; the only operational difference between the two display modes (for which programmers need to allow) is the number of colors available on the screen. A color VGA system will show CGA and EGA graphics on its screen; a monochrome VGA system will do likewise—without the special drivers that are required by Hercules.

In addition, because VGA monochrome displays use analog signals, they have the potential to offer a near-infinite number of shades of gray. MDA and Hercules display systems are limited to three levels: black, white, and highlighted, although some video boards squeeze out up to 16 gray levels with clever programming. A composite monitor attached to a CGA adapter is also limited to 16 gray levels. All VGA gray levels can be put to work showing halftone images for desktop publishing and realistic shading for electronic modeling—something Hercules is hard-pressed to do.

Moreover, the Hercules card can be a hassle to use. You've got to worry about a mode-shifting program to make use of some applications—and you're left to wonder whether each program you run requires HGC HALF or HGC FULL for proper operation. And you've got to modify BASIC if you hope to get graphics images on your Hercules monochrome screen.

With monochrome VGA, you just run programs. No hassles, no problems, no rough edges.

### HERCULES' STRENGTHS

But Hercules has its own strengths. It's generally cheaper, at least today. While monochrome VGA is still new enough and in strong enough demand that deals are hard to come by, Hercules graphics is a buyer's market. Shop around. You can buy a Hercules-compatible display board (Monographics) for \$49 from CompuAdd Corp. ((800) 666-1872) and a Hercules-compatible Samsung MA2565 display for \$77 from Express Micro Mart ((800) 533-0177). The lowest nonlist price we found for a monochrome VGA display alone exceeds that total cost by \$3 (the Magnavox 7BM749 at \$129, from Tussey Computer Products and others). A VGA board will add at least \$220 to your system price (for a CompuAdd VGA card).

Then again, the extra money spent on a VGA board is not necessarily wasted. Should you decide to make the move to color, the same adapter will run a monochrome or color display. A Hercules card keeps its value in another way—you can usually run both a Hercules adapter and color VGA simultaneously on one computer system without creating conflicts. You can't plug two VGAs into the same computer—even if you set one up as color and one as monochrome.

Which is better? In the long run, VGA wins. It's sharper and more compatible, and it makes more realistic images. But if you just want to crunch through numbers and text, a cheap monochrome system (Hercules or otherwise) will get you going for a few bucks less. ■

more in the specifications sheet than on test results. Among the former are the type of synchronization, phosphor color, and screen size.

Synchronization is the watershed between two technologies: The VGA specification calls for a fixed-frequency display, one with a horizontal scanning frequency of precisely 31.150 kHz. However, to ensure compatibility with old, current, and future standards, some manufacturers (no-

tably Princeton Graphics Systems and NEC) have elected to design multiscanning monochrome displays that accept everything from CGA frequencies (15,575 Hz) to the so-called VGA-plus range of about 35,000 Hz. The trade-off: monochrome true-VGA displays are the least expensive that you can connect to your system. Multiscanning monochrome displays cost more—perhaps double.

The value of the extra synchronizing

range depends on your perspective and the exact capabilities of the display. In an office computer pool, a multiscanning monitor can be a system manager's savior—one display will plug into virtually any computer. Conversely, if all you've got is true-blue IBM PS/2, you won't tap any display's multiscanning abilities. Beyond what you have today, multiscanning offers the promise of adapting to future higher-resolution display standards.

The growth potential of any multiscanning display depends on its scanning range. The wider the synchronizing range, the more of a guarantee you have against obsolescence. The range that's currently most popular from CGA to VGA—plus—35 kHz—probably won't stretch beyond today's resolution levels. (Even the potential 800- by 600-pixel standard with a 60-Hz frame rate, which is being discussed within the display industry, may be beyond the reach of a 35-kHz monitor.)

Choice of phosphors raises two issues: color and persistence. Phosphor color is more a fashion than technical issue. Tastes have pushed us from green screens reminiscent of World War II radarscopes to high-fashion European amber to today's prevailing paper-white, hailing back both to the Macintosh and to Howdy-Doody. Science gives little guidance in color choice. The best that studies have done is

**A white display best fits the screen-as-paper metaphor and is, to some, easiest on the eyes.**

to determine that if you stare at any screen without relief for many hours—no matter the color—your eyes will hurt. Common rule of thumb: Green earns preference for darker work areas; amber for bright. White best fits the screen-as-paper metaphor and is, to some, the easiest on the eyes.

With VGA displays, phosphor persistence is not a major issue. The majority of VGA modes use a 70-Hz frame rate. (Thirty-line VGA text modes use a 60-Hz rate.) Long-persistence phosphors, which smooth over the flicker of lower frame rates, become necessary for most people only at frame rates of 50 Hz or lower. The ghostly after-images caused by long-persistence phosphors is enough of a bother that you probably won't want to tangle with long persistence.

#### PERSISTENCE AN ISSUE

In multiscanning displays, persistence is more of an issue, because you may be tempted to use one in an interlaced display

system such as those that follow the IBM 8514/A standard. Most interlaced display systems have low frame rates, dividing the image into two intermeshed fields to give a higher apparent frame rate. Some eyes are tricked by interlacing. Others see right through the subterfuge and the flicker. For them, the best choice may be the only display in this review with a lingering phosphorous glow: the Princeton Graphics Systems Max-15.

Screen size is a matter of preference, desk space, and myopia. A big screen is easier to see but takes up more room and usually costs more. As with television sets, monitor screens are measured diagonally, a throwback to the days when tubes were round. Now the figures serve only to exaggerate what you might expect as image size. A typical 12-inch screen like IBM's 8503 yields an image that measures only 6 by 8 inches, with each character about 3/16 inch tall. Little wonder most aftermarket displays use 14-inch tubes.

The proof of any display is what you see on the screen. You want to see a good, sharp image. You don't want to see glare or distortion. All of the displays reviewed here have screens that have been in some way treated to reduce glare. Many, however, suffer from image distortion.

An on-screen image is supposed to be rectangular. Electronic problems or poor mechanical design can result in an image that is as distorted and bent as your average urban taxicab. With text you might not notice the aberrations, but put graphics on the screen (or simply wrap a full-screen box around your text) and the misshapen images will haunt you for certain.

The large number of displays in this review reflects the competition for this lucrative niche in the industry and PC Labs' broad selection standards. To qualify for this review, monitors had to use cathode-ray tubes having a single phosphor color (amber, green, or white) and measure between 12 and 15 inches diagonally. In addition, reviewed monitors must also have analog inputs compatible with the VGA standard and the ability to synchronize with the 31.15-kHz signals used in VGA display modes, ensuring proper operation with any standard VGA system. In other words, all of these displays are prospects for connection to your VGA system. And check out monitors from the few companies whose monitors didn't arrive in time for review here; they include models from

Amstrad, IBM, and Panasonic.

Although the distinctions among many of these products are fine, you should be careful what you choose. The monitor you buy will probably be a commitment you'll live with for the next few years.

*Winn L. Rosch is a contributing editor of PC Magazine.*

#### AMDEK CORP.

### Amdek AM432

Amdek has been a major PC display vendor since the early 1980s and a pioneer in the field. Its model AM432 reflects the maturity of a company that knows how to do its business right.

The AM432 is a competent monochrome flat-screen VGA monitor. At \$245 for either the white or the amber version, the AM432 costs more than we'd like, but the price isn't out of line with other major vendors'. This is a VGA-adaptor-only display, with a maximum graphics resolution of 640 by 480.

#### CLEARLY DISTINCT GRAYS

The Amdek monitor did a fine job on the VGA Line Patterns test, displaying clearly distinct shades of gray. The complex image was very clear. There was a small amount of folding in the upper-left and right corners on the full-screen white-image-distortion test; certainly we'd rather see none, but in this case it was minor. The Amdek uses chemically etched glass for glare protection; the result was very effective in our lab setting.

The integral base tilts about 20 degrees and swivels a broad 270 degrees, enough to show the screen to anyone nearby who isn't positioned directly in front of your desk. The attached video cable has a 15-pin connector and, at 46 inches, is more than long enough if the monitor sits on top of your system unit. The cable may also be long enough if the system is on the floor directly under the monitor and behind your desk, but the cable probably won't reach a computer beside your desk unless you use a cable extension or position the monitor near the same side.

The power switch is on the right side, along with the brightness and contrast controls. The physical controllers for brightness and contrast are rolling-ball switches that work fine but have a lot of extra move-







MONITORS  
MONOCHROME VGA MONITORS



FACT FILE

**Amdek AM432**

Amdek Corp., 1901 Zanker Rd., San Jose, CA 95112; (408) 436-8570.

List Price: \$245

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 13 inches

CIRCLE 614 ON READER SERVICE CARD



The Amdek AM432, available in either white or amber, has fine image resolution, good color separation, and only slight image distortion in the upper corners. This acceptable though unexciting VGA-only display has a generous 270 degrees of swivel action and acceptable glare protection.

**AOC MN413**

AOC International USA Ltd., 10991 NW Anworld Dr., Kansas City, MO 64153; (816) 891-8065, (800) 443-7516.

List Price: \$229.95

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12½ inches

CIRCLE 615 ON READER SERVICE CARD



The AOC MN413 from AOC International USA has exceptional resolution and a power-saving quick-turn-on feature. Apart from slight bowing, this white-on-black, flat-screen analog monitor is a good performer.

ment. As is usual for this monitor type, there are no user-adjustable vertical or horizontal controls.

There's nothing terribly special about the Amdek AM432. It does what it's supposed to do adequately and without fuss. It's a good choice.

**AOC INTERNATIONAL USA LTD.**

**AOC MN413**

AOC International USA's AOC MN413 14-inch flat-screen monitor has some nice features that help it stand out from the crowd. The \$229.95 unit includes particularly good resolution and a quick power-on feature that saves electricity but doesn't make you wait for the screen to warm up.

The MN413's diagonal image size is

actually 11¾ inches, taking up most of the 12½ inches of screen exposed by the monitor's case. The attached 54-inch cable has a 15-pin D-shell connector to plug into a PS/2 or VGA video adapter card. Only VGA adapters need apply, as this unit—like most monitors tested—is set up for VGA only. The maximum resolution in graphics mode is 640 by 480.

**INTEGRAL TILT/SWIVEL**

There is an integral tilt/swivel base with 90 degrees of swiveling and approximately 20 degrees of up-and-down tilting. The monitor uses chemical etching for glare protection, which, with the flat screen, proves effective.

The white-on-black screen showed a slight bowing in the upper-right corner in our full-screen white-image-distortion test, but not enough to cause concern for most people; you may not even notice it.

There was also one incomplete line; in the full-screen test, the topmost line stopped about three-fourths of the way across the screen. The full color set, though, was differentiated by distinct shades of gray, and the VGA Line Patterns test images I put on the screen had exceptional clarity.

The only screen-adjustment controls are for contrast and brightness. Both of these, as well as the on/off switch, are conveniently located on the bottom-right front of the monitor. There are no other controls, but in this case a vertical-positioning knob would have been helpful since the image was somewhat above center.

This model doesn't provide absolutely precise alignment on the full screen, but its exceptionally clear resolution makes the AOC MN413 an agreeable choice.

**COMPAQ COMPUTER CORP.**

**Compaq Monochrome Video Graphics Monitor**

The \$255 Compaq Monochrome Video Graphics Monitor is a white-on-black unit with a maximum graphics resolution of 640 by 480. The Compaq Computer Corp. unit, although on the small side with a 9¾-inch diagonal image size and a screen size of 10¼ inches, is very nice looking and has exceptional glare protection.

This VGA-adapter-only model has an attached 72-inch cable with a 15-pin connector; the longer-than-usual cable is especially helpful if you put your system unit

**The Compaq's 72-inch cable helps if the system unit is beside or under a desk.**

beside or under your desk. There is a tilt/swivel base with 20 degrees of tilting and 90 degrees of swivel. Compaq refers to the base as an "integral" assembly, but it comes separately in the monitor box for you to put together yourself. The nice thing about this component approach,


# MONITORS

## MONOCHROME VGA MONITORS



### VGA MONOCHROME MONITORS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	 Imtec 1261L	Datafox DF-14S2	KDS KD-14S2	Samsung ML2611
	\$149.00	\$159.00	\$175.00	\$189.00
Diagonal screen size (inches)	11.25	12.5	12.5	11.25
Diagonal image size (inches)	11.25	11	11.75	10.75
Maximum resolution	640 x 480	640 x 480	640 x 480	640 x 480
Bandwidth (MHz)	30	35	35	30
Vertical scanning frequency (Hz)	60/70	50/60/70	50/60/70	60/70
Horizontal scanning frequency (Hz)	31.47	31.5	31.5	31.47
Text-mode color	White	White	White	White
Case dimensions (inches)				
Height	12.25	13.0	13.0	12.0
Width	12.25	12.75	12.8	12.25
Depth	11.75	13.0	13.0	11.75
Tilt/swivel base	●	●	●	●
Cable length (inches)	42	42	47	62
Cable detachable	○	○	○	○
INPUTS				
RGB	○	○	○	○
Composite	○	○	○	○
Separate synchronization	○	○	○	○
Analog	●	●	●	●
Connector types	15-pin D-shell	15-pin D-shell	15-pin D-shell	15-pin D-shell
CONTROLS				
Brightness	●	●	●	●
Contrast	●	●	●	●
Vertical position	○	○	○	○
Vertical size	○	○	○	○
Horizontal position	○	○	○	○
Horizontal size	○	○	○	○
Text mode	○	○	○	○
Over/underscan	○	○	○	○
COMPATIBLE ADAPTERS				
CGA	○	○	○	○
MDA	○	○	○	○
EGA	○	○	○	○
VGA	●	●	●	●
Hercules	○	○	○	○
Apple Macintosh	○	○	○	○

 Editor's Choice ●—Yes ○—No

MONITORS
MONOCHROME VGA MONITORS

**CTX-VGA  
Monochrome  
CM-2452**
**\$199.00**

12.25

11.25

640 x 480

30

60/70

31.47

Amber, green, or  
white

**GoldStar VGA  
Monochrome 1220W**
**\$199.00**

11.5

11.0

640 x 480

30

60/70

31.5

White

**Tatung MM1233**
**\$199.00**

11.25

10.5

640 x 480

30

50/60

31.47

White

**Tandy VGM-100**
**\$199.95**

12.75

11.25

640 x 480

30

59.95/70.08

31.47

White

**Magnavox  
Professional VGA  
Display 7BM749**
**\$229.00**

12.5

12.5

640 x 480

22

60/70

31.5

White

11.75

12.75

12.5

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70

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●

15-pin D-shell

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11.2

12.9

12.2

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15-pin D-shell

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12.5

12.5

12.5

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15-pin D-shell

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13.0

13.25

12.75

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72

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15-pin D-shell

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14.25

13.0

11.5

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15-pin D-shell

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CONTINUES

MONITORS
MONOCHROME VGA MONITORS



# VGA MONOCHROME MONITORS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	Quilmax DM-3014	Compaq Monochrome Video Graphics Monitor	Packard Bell PB8503MG	Tatung MM1295
	\$250.00	\$255.00	\$279.00	\$289.00
Diagonal screen size (inches)	13.25	10.75	11.25	11.5
Diagonal image size (inches)	11.75	9.875	10.75	11.0
Maximum resolution	640 x 480	640 x 480	640 x 480	800 x 600
Bandwidth (MHz)	30	30	30	30
Vertical scanning frequency (Hz)	50/60/70	60/70	59.95/70.08	50/60/70
Horizontal scanning frequency (Hz)	31.47	31.47	31.47	31.47
Text-mode color	White	White	White	White
Case dimensions (inches)				
Height	13.0	12.25	11.5	12.5
Width	12.75	11.7	12.5	12.5
Depth	13.25	12.6	11.5	12.5
Tilt/swivel base	●	●	●	●
Cable length (inches)	66	72	63	60
Cable detachable	○	○	○	●
INPUTS				
RGB	○	○	○	○
Composite	○	○	○	○
Separate synchronization	○	○	○	●
Analogue	●	●	●	●
Connector types	15-pin D-shell	15-pin D-shell	15-pin D-shell	9- and 15-pin D-shell
CONTROLS				
Brightness	●	●	●	●
Contrast	●	●	●	●
Vertical position	○	○	○	●
Vertical size	○	○	○	●
Horizontal position	○	○	○	●
Horizontal size	○	○	○	●
Text mode	○	○	○	○
Over/underscan	○	○	○	○
COMPATIBLE ADAPTERS				
CGA	○	○	○	○
MDA	○	○	○	○
EGA	○	○	○	○
VGA	●	●	●	●
Hercules	○	○	○	○
Apple Macintosh	○	○	○	○

●—Editor's Choice    ●—Yes    ○—No

**MONITORS**  
**MONOCHROME VGA MONITORS**

**Packard Bell  
PB8505MG**

\$299.00

11.5

10.0

640 x 480

30

50/60/70

31.47

White

12.25

12.5

12.25

●

41

○

○

○

○

●

15-pin D-shell

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○

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**Zenith MM149-P**

\$299.00

12.75

11.75

640 x 480

30

60/70

31.49

Amber or white

10.25

13.0

12.75

○

72

○

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●

15-pin D-shell

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**NEC MultiSync GS**

\$349.00

12.5

12.25

640 x 480

30

50/60/70

31.5

Amber, green, or  
white

13.25

13.25

13.0

●

64

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9-pin D-shell  
(includes 9/15-  
pin adapter)

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**TVM MG-11**

\$349.00

12.75

11.0

1,024 x 768

30

45-75

15-38

White

13.0

13.0

14.75

●

69

●

○

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●

9- and 15-pin  
D-shell

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**Princeton  
Graphics Systems  
Max-15**

\$389.00

12.5

11.75

1,024 x 768

45

45-120

15-36

White

12.25

12.5

13.0

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73

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9-, 15-, and 25-  
pin D-shell, RCA  
composite jack

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ENDS

# MONITORS

## MONOCHROME VGA MONITORS



### FACT FILE

#### Compaq Monochrome Video Graphics Monitor

Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (713) 370-0670, (800) 231-0900.

List Price: \$255

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 10 1/2 inches

CIRCLE 616 ON READER SERVICE CARD



The Compaq Monochrome Video Graphics Monitor has good glare protection and is a convenient size. A detachable tilt/swivel base and 72-inch cable add to the versatility of the 12-inch white-on-black monitor.

#### CTX-VGA Monochrome CM-24S2

CTX International Inc., 161 Commerce Way, Walnut, CA 91789; (714) 595-6146.

List Price: \$199

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 1/4 inches

CIRCLE 617 ON READER SERVICE CARD



CTX International's CTX-VGA Monochrome CM-24S2 is a very good buy with no distortion, clear images, and several extra screen adjustment controls. Available in white, amber, and green, the monitor comes with a 70-inch cable.

however, is that if you don't want the base, you don't have to use it—good if you're fitting the monitor on a shelf or in a space where the base either wouldn't fit or wouldn't be necessary.

The screen brightness and contrast controls are located in the center of the right side of the case. The contrast control has a detent (a stop or click) in the middle of the adjustment range. The on/off switch is on the back of the monitor.

#### TESTING THE COMPAQ

In testing, the Compaq monitor separated the color boxes well and offered fine resolution. In our full-screen white-image-distortion test, there was minor folding in the upper-left corner.

It's likely that few people buy Compaq monitors separately. Compaq isn't in the monitor business; it's in the computer business and sells monitors to accompany its computers. In most cases, then, you'd probably not consider buying this unit by

itself. If a black-and-white VGA monitor is what you need, however, because of preference or budget, rest assured that the Compaq unit is a competent performer.

#### CTX INTERNATIONAL INC.

### CTX-VGA Monochrome CM-24S2

CTX International's entry in this grouping isn't the least expensive, but it does everything well, has most of the right features, and comes at a fairly good price.

At \$199, the CTX-VGA Monochrome CM-24S2 monitor is available with a white, green, or amber display; PC Labs evaluated the amber version. All of the CM-24S2s use chemical etching to cut

down on glare; this worked well on the test unit as shown in the 90 Degrees Monitor Glare Test.

The nondetachable video cable is 70-inches long—ample for most system-unit and monitor-placement arrangements. The cable has a 15-pin connector for VGA adapters only, common among this class of monitors. As usual, the maximum graphics resolution is 640 by 480.

The CTX monitor has horizontal-position and vertical-size controls on the back—the type you have to reach into with a tiny screwdriver, but at least they're there.

The base tilts 20 degrees, which is standard, but swivels a miserly 90 degrees. If you're going to show a display to someone else, that person had better be on your side of the desk unless you want to pick up the monitor.

#### HIDDEN POWER SWITCH

The CM-24S2's power switch is on the back (inconveniently), and the brightness and contrast controls are on the right side. There are horizontal-position and vertical-size controls on the back—the inconvenient type you have to reach into with a tiny screwdriver to adjust, but at least they're there.

The monitor produced unexceptional results on our tests. There was no distortion on the full-screen white-image-distortion test, and on the VGA Color Bars test, all of the color bars that were supposed to be displayed as distinct shades of gray indeed were. The complex graphics image was very clear.

It's nice to work with products that deliver what they're supposed to. The CTX-24S2 is a respectable choice at a fair price. If the company knocked \$30 off the price, it would probably sell a lot more.

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## DATAFOX COMPUTER PRODUCTS

### Datafox DF-14S2

The Datafox DF-14S2 monitor is a price-to-performance leader among many similar units. At \$159, the Datafox Computer Products unit isn't the least expensive monitor in this batch, but it's only \$10 more than the cheapest unit—below the average in price, though not in performance.

Admittedly, there was a slight folding in the upper-left corner of the screen in our full-screen white-image-distortion test, but it was so small that few users would ever notice. The color separation into shades of gray (VGA Color Bars test) and the complex line-graphics images (VGA Line Patterns test) were outstandingly clear, and the screen image was rock solid, so much so that it stood out among other monitors that just "seemed" steady. This is a pleasant monitor to work with.

#### SHORT CABLE

The DF-14S2 has a nondetachable 42-inch cable with a 15-pin plug for VGA adapters only. I'd rather have a longer cable to allow more versatility in monitor placement without having to buy a cable extension. The built-in tilt/swivel base has a generous 30 degrees of tilting and a full 360 degrees of swiveling motion.

The 11-inch (diagonal image size) flat screen is available in either amber or paper white, both at the same price. The test unit was the paper-white version. The chemical etching process used for glare protection is effective and will help if your office has the fluorescent-light overkill that's typical in offices.

The power switch and the brightness and contrast controls are all located on the right side of the monitor case. There are no other controls.

At \$159 list, the DF-14S2 is a good buy. I'll take mine in paper white, please.

## EPSON AMERICA INC.

### Epson VGA Monochrome

You probably won't buy an Epson America monitor all by itself. Epson is better known for its printers and computers, and

## MONITORS MONOCHROME VGA MONITORS



#### FACT FILE

##### Datafox DF-14S2

Datafox Computer Products, Division of Pierce-Phelps Inc., 2215 E. University, Phoenix, AZ 85034; (800) 821-6317, (215) 879-7080.

List Price: \$159

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 1/4 inches

CIRCLE 618 ON READER SERVICE CARD



Datafox Computer Products' Datafox DF-14S2 has a short cable and a bit of upper-left-corner folding, but otherwise this monitor has terrific resolution, a clear, steady paper-white image, and a great price.

##### Epson VGA Monochrome

Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (800) 922-8911.

List Price: \$249

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 11 1/4 inches

CIRCLE 619 ON READER SERVICE CARD



The Epson VGA Monochrome monitor has slight image bowing, though not enough to unnerve you unless you need higher-quality graphics than this category usually offers. Good shade separation, clear images, a 180-degree tilt/swivel base, and a hefty 72-inch cable top off a good choice.

most of the monitors it sells are part of full computer system configurations. If you specify an Epson VGA Monochrome monitor when you buy an Epson computer, you'll probably be very happy.

At a standalone list price of \$249, however, the Epson VGA Monochrome monitor not only costs more than you'll pay for a no-name brand, it's also pricier than the well-known Tandy brand. But since this monitor sells for less than the Compaq monochrome VGA display (although only \$6 less!), some might see it as a low-cost alternative.

#### GOOD PERFORMANCE

Price aside, the Epson VGA Monochrome display performed reasonably well. The shade separation was very good, and the complex image resolution and sharpness on the VGA Line Patterns test was terrific. There was some bowing on the upper-left side of the full-screen white-image-distortion

test, but it wasn't too noticeable. You certainly shouldn't let this hold you back if you're going to use your computer for word processing, spreadsheet, or database work.

The tilt/swivel base tilts about 20 degrees and swivels a good 180 degrees. The attached 72-inch cable is the length we like to see, as it gives you the flexibility to move your system components around; you probably could stand the CPU on the floor and put the monitor in the middle of your desk or off to one side. The cable's 15-pin connector works with VGA adapters only; the maximum graphics resolution is 640 by 480.

The Epson has a white-on-black screen with no other colors available. The glare protection, accomplished with chemical etching, is only moderately effective. The power switch and the brightness and contrast controls are all located on the right side of the monitor case. The brightness

**MONITORS**  
**MONOCHROME VGA MONITORS**

control has a detent (a noticeable stop at the middle adjustment position).

The Epson monochrome VGA screen isn't a barn burner, but it doesn't have to be. It performs adequately and is usually bundled or discounted with systems.

**GOLDSTAR TECHNOLOGY INC.**

**GoldStar VGA  
Monochrome 1220W**

Close but not quite. The \$199 GoldStar VGA Monochrome 1220W is a 12-inch monochrome VGA monitor that has all the right features, including a longer-than-usual 71-inch video cable with a 15-pin plug. Unfortunately, the 1220W did not do as good a job as most of the other monitors when tested at displaying distinct color bars as shades of gray. A VGA Line Patterns test image, using thin lines of different shades of gray, was also pretty fuzzy.

**NO DISCERNIBLE BOWING**

GoldStar did a fine job on the full-screen white-image-distortion test, with no discernible bowing or folding in the corners. The paper-white monitor has an adequate amount of glare protection, achieved with a chemical etching process.

**GoldStar did a fine job  
on the full-screen  
white-image-distortion  
test, with no  
discernible folding in  
the corners.**

The GoldStar has a built-in tilt/swivel base that tilts approximately 20 degrees and swivels 180 degrees. Other than the power switch, the only user-adjustable controls are for contrast and brightness, the latter with a detent at the brightness midpoint. The maximum graphics resolution is 640 by 480. The 1220W is compatible with VGA adapters only.

GoldStar monitors are manufactured in



**FACT FILE**

**GoldStar VGA Monochrome 1220W**  
GoldStar Technology Inc., 1130 E. Arques Ave.,  
Sunnyvale, CA 94086; (408) 737-8575.  
List Price: \$199  
Requires: VGA adapter with 15-pin connector.  
Diagonal Screen Size: 11½ inches

CIRCLE 620 ON READER SERVICE CARD



GoldStar Technology's GoldStar VGA Monochrome 1220W meets the standard specs for monochrome VGA monitors but falls short for high-end graphics applications. The model includes a good 71-inch video cable and a tilt/swivel base with a greater-than-average range of movement.

**HP Vectra VGA Monochrome**  
Hewlett-Packard Co., Customer Information  
Center, Inquiry Fulfillment Dept., 19310  
Prunefield Ave., Cupertino, CA 95014; (800)  
752-0900.  
List Price: \$250  
Requires: VGA adapter card with 9- or 15-pin  
connector.  
Diagonal Screen Size: 12¼ inches

CIRCLE 621 ON READER SERVICE CARD



The HP Vectra VGA Monochrome monitor is a top-performing display available with an amber, green, or soft white screen. Fine shade separation, freedom from image distortion, and a detachable cable top off a fine list of features.

Korea and are often included with computer systems as well as sold by themselves. The lower-than-average price is right, but the fuzzier-than-average image and relative lack of shade separation keep the 1220W from being a contender.

degrees of tilt and 180 degrees of swivel is standard equipment with the system.

**HEWLETT-PACKARD CO.**

**HP Vectra VGA  
Monochrome**

Hewlett-Packard Co.'s HP Vectra VGA Monochrome monitor is a lot to order if you're short of breath, but this \$250 unit is long on features and high in performance.

The Vectra includes a detachable, 9-pin input, a 63-inch video cable, and a 9-/15-pin adapter. An integral base with 20 de-

**COLOR SELECTION**

If you're fussy about your monochrome's single color (and many people have strong preferences), HP lets you choose among amber, green, and "soft" white displays. The test unit was green, in contrast to most of the other vendor-supplied test units, which were paper white. The monitor's case was one of the few two-tone units, with an eggshell back and a light-gray screen frame. The only user-adjustable controls are for brightness and contrast; both are located on the bottom right of the front of the case, and the power switch is on the bottom left of the front.

There is hardly any glare at all, thanks to the chemically etched screen, and the Vectra's maximum resolution is 640 by 480 in graphics mode. In our VGA Color

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At last.

*Craig Bruce—a mannequin dealer  
in Oakland, California—is normally far too busy  
to spend hours on his desktop publications.*



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# FINESSE



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**CIRCLE 182 ON READER SERVICE CARD**



Bars test, the unit's gray shade differentiation was very good (though in this case the shades were green). The full-screen white-image-distortion test showed nice, square corners with no perceptible distortion.

You may not think of Hewlett-Packard as a monitor vendor; indeed, most of its monitors are sold with computer systems. The HP Vectra VGA Monochrome monitor, however, is a fine unit worth purchasing by itself.

#### KOREA DATA SYSTEMS CO. LTD.

### KDS KD-14S2

Korea Data Systems Co.'s KD-14S2 has recently had a price decrease, making it more competitive. This 14-inch, etched, flat-screen monitor now lists for \$175, down from its earlier \$199. The KDS is available with either a paper-white or amber screen; we tested only the paper-white version.

The KD-14S2 performed well on both our full-screen white-image-distortion test and our VGA Color Bars test. There was no discernible distortion on the former and fairly good separation on the latter; corners were rock-solid, too. A fine-line complex graphic image was a bit on the fuzzy side, but probably not enough to be noticeable with text-based applications like word processors and spreadsheets. And in the Monitor Glare Tests, the KDS did best in the 30 and 45 Degrees tasks.

The attached video cable is on the short side at 47 inches. The 15-pin D-shell connector is for VGA adapters only. Maximum graphics-mode resolution is 640 by 480. Also, the KD-14S2 has a tilt/swivel base that tilts a relatively standard 20 degrees but swivels a full 360 degrees for maximum versatility.

As is usual for nonmultiscanning monochrome VGA monitors, the KD-14S2 has adjustment controls only for brightness and contrast. Both controls are located on the right side of the monitor case, as is the power switch.

At \$175, the KD-14S2 is one of the more-aggressively priced monochrome VGA monitors. The slight fuzziness in the test unit, if typical, won't matter if you're not planning on using the monitor for design or graphics applications. Of course, if you do need the highest quality graphics, you'd probably be looking at a color monitor anyway.



#### FACT FILE

##### KDS KD-14S2

Korea Data Systems Co. Ltd., 6 Blackstone Valley Pl., Lincoln, RI 02865; (401) 334-0100.  
List Price: \$175

Requires: VGA adapter with 15-pin connector.  
Diagonal Screen Size: 12 1/2 inches

CIRCLE 622 ON READER SERVICE CARD



The KDS KD-14S2 is a good deal in a 14-inch flat-screen monitor. Despite a slight image fuzziness, the KDS has rock-solid corners and good gray-shade separation. It is a good performer with the expected features, specifications, and controls. The base swivels a full 360 degrees.

#### EDITOR'S CHOICE

##### Imtec 1261L

Leading Technology Inc., 10430 SW 5th Ave., Beaverton, OR 97005; (503) 646-3424, (800) 999-5323.  
List Price: \$149

Requires: VGA adapter with 15-pin connector.  
Diagonal Screen Size: 11 1/2 inches

CIRCLE 623 ON READER SERVICE CARD



Leading Technology's Imtec 1261L is the price leader and has good shade separation, clear images, and no distortion. With a 62-inch cable and a 180-degree swivel, this paper-white screen display is a hard deal to beat.

##### NEC MultiSync GS

NEC Home Electronics (U.S.A.) Inc., Computer Products Division, 1255 Michael Dr., Wood Dale, IL 60191-1094; (312) 960-9500.  
List Price: \$349

Requires: CGA, MDA, EGA, VGA, or Hercules adapter with 9- or 15-pin connector.  
Diagonal Screen Size: 12 1/2 inches

CIRCLE 624 ON READER SERVICE CARD



NEC Home Electronics' multiscanning NEC MultiSync GS monitor performs beautifully, and it has a good 64-inch detachable cable, a full 360-degree swivel base, and lots of input and control flexibility. Its only limitation is the 640-by-480-pixel maximum resolution while some of its competitors offer 1,024 by 768 resolution at the same price level.



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CIRCLE 191 ON READER SERVICE CARD

**MONITORS**  
**MONOCHROME VGA MONITORS**

**LEADING TECHNOLOGY INC.**

**Imtec 1261L**

If you're looking for the least expensive VGA monitor you can find, stop right here. If you're also eliminating the monitors that gave us any distortion or shade-separation problems, this one stays in the game. The \$149 Imtec 1261L even has a moderately long video cable and a gener-

ous 180-degree-swivel base.

The Imtec's base also tilts approximately 20 degrees, the de facto standard with display monitors. The video cable has the expected 15-pin connector, works with VGA adapters only, and has a maximum resolution of 640 by 480 in graphics mode. The screen is chemically etched and has moderately good glare protection.

What else do you need to know? Well,

it comes in white only, and all of the controls (limited to power, contrast, and brightness) are on the right side. To be more precise, the controls are on the bottom-right side of the unit's front; the point is that they're all in the same convenient location.

The first test unit we received had a severe vertical synchronization problem. Leading Technology (the Imtec vendor and *not* the same company as Leading Edge) immediately sent another unit,

**BENCHMARK TEST: VGA Monochrome Monitors**

The **VGA Color Bars** test determines how well a monochrome VGA monitor can tell apart the 256 colors displayed by an IBM 8513 VGA color monitor using the PS/2 Model 70-A21. As shown here in cropped photographs of each monitor, results varied, although most of these models fared well in defining distinct shades of gray.

At the high end of gray-shade separation are monitors from companies like CTX, Leading Technology, Hewlett-Packard, NEC, Tandy, Wyse, and Zenith. Several companies' monitors, however, proved inconsistent from one model to another—as shown by those of Packard Bell, Tatung, and TVM. ■



**AOC MN413**



**Compaq Monochrome Graphics**



**CTX-VGA Monochrome CM-24S2**



**Datafax DF-14S2**



**Epson VGA Monochrome**



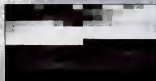
**GoldStar VGA Monochrome 1220W**



**HP Vectra VGA Monochrome**



**KDS KD-14S2**



**Imtec 1261L**



**NEC MultiSync GS**



**Packard Bell PB8503MG**

**MONITORS**  
**MONOCHROME VGA MONITORS**

which performed without a flaw. Resolution and image clarity were extremely good and there was no detectable image distortion. Shade separation was also above average.

The Imtec's only drawbacks showed up in the Monitor Glare Tests, where it scored high in the percentage of light reflected. Note, however, how similarly these monitors fared across the board.

Overall, the Imtec 1261L is a darned good monitor at a great price.

**NEC HOME ELECTRONICS (U.S.A.) INC.**  
**NEC MultiSync GS**

Here's a contender from the royal family of multiscanning monitors. NEC Home Electronics has been the recognized market leader in multisynchronous computer

displays for 4 years, beginning with the original NEC MultiSync color EGA monitor and followed by further versions. NEC's monochrome VGA monitor, the MultiSync GS, is a worthy representative of the line.

The MultiSync GS's \$349 list price is a lot to pay if you're just looking for a monochrome VGA monitor, but if you want the flexibility and quality of a multisynchronous unit, the GS is in the middle of the current price range. Your \$349 buys very



**Packard Bell PB8505MG**



**Magnavox 7BM749**



**Princeton Max-15**



**Quimax DM-3014**



**Reliays RE9503**



**Samsung ML2611**



**Samsung ML4571**



**Tandy VGM-100**



**Tatung MM1233**



**Tatung MM1433**



**Tatung MM1295**



**TVM MG-14**



**TVM MG-11**



**Wyse Technology WY550**



**Zenith MM149-P**

**MONITORS**  
**MONOCHROME VGA MONITORS**

good performance; there's no full-screen image distortion and almost total gray-scale shade separation (there were two differentiations the MultiSync GS failed to make). The VGA Line Patterns test image was gorgeous and steady.

You can get the MultiSync GS with either an amber, green, or paper-white display; the test unit had a white screen. NEC uses etching for glare protection, which proved to be very effective on this particular screen.

The detachable video cable is 64 inches long, a reasonable length. The cable has a 9-pin connector on the computer end, but a 9-/15-pin adapter is included. You can use this monitor with both RGB TTL and analog input ports. The MultiSync GS is compatible with CGA, MDA, EGA, VGA, and Hercules video adapters.

#### **RESOLUTION FALLS SHORT**

The maximum graphics resolution on the NEC MultiSync GS is 640 by 480; it is the one area where the unit falls short. Most of the other heavy-hitter monochrome multiscanning monitors have a maximum resolution of 1,024 by 768. If the highest resolution you're going to use is normal

VGA, then you're all set, but the higher capabilities of the new Super VGA adapters suggest that more is better. Besides, if the other guys have it, NEC should have it as well. Since NEC doesn't often follow others in this field, I would look for an upgrade soon.

The MultiSync GS's tilt/swivel base has the typical 20-degree tilt range, but it swivels the full 360 degrees. This is one of the few monitors you can turn all the way around to show a screen to the person who sits in front of the desk.

The NEC has lots of screen-adjustment controls, most of which are placed with the power switch on the top-right of the monitor's front. The controls include brightness, contrast, vertical position and size, and horizontal position. There's also a TTY/analog switch on the back of the case.

Personally I'd wait for the 1,024-by-768 version of the NEC MultiSync GS, which I suspect is on the way. If the 640-by-480 limitation isn't a factor for you, and if you want multiscanning, you have to consider the MultiSync GS.

**PACKARD BELL**  
**Packard Bell**  
**PB8503MG**  
**Packard Bell**  
**PB8505MG**

Packard Bell sells two 12-inch monochrome VGA monitors, the \$279 PB8503MG and the \$299 PB8505MG. The differences between the two are relatively minor from a user's standpoint. Neither monitor is exceptional at displaying complex graphics, and both had noticeable problems with the distortion test. These two monitors could be fine for text-based applications, but prices at the higher end of the scale for nonmultiscanning monitors make the Packard Bell units questionable buys at best.

Both the PB8503MG and the PB8505MG have white text screens and use a combination of dark tinting and chemical etching for glare protection, a technique that works well. Both monitors

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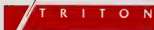


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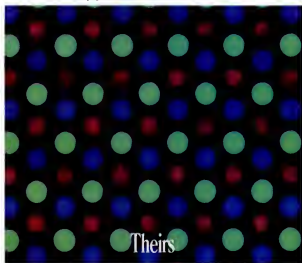
A spotless screen brightens Windows, and all your software. Measurably. That's why we use solid bars of color, instead of unconnected "spots," in our high-resolution CM-1430 monitors.

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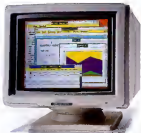
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*Unretouched Close-Up of Our Seiko Instruments CM-1430 Monitor in VGA Mode.*



*Unretouched Close-Up of a NEC MultiSync® Monitor in VGA Mode.*



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# NEC



**MONITORS**  
**MONOCHROME VGA MONITORS**



**FACT FILE**

Packard Bell, 9425 Canoga Ave., Chatsworth, CA 91311; (818) 773-4400.

**Packard Bell PB8503MG**

List Price: \$279

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 11½ inches

CIRCLE 625 ON READER SERVICE CARD



Unacceptable screen-image tilting is troublesome for the Packard Bell PB8503MG. The white-on-black unit has a base that tilts 20 degrees and swivels a full 180 degrees. It is equipped with a 63-inch attached cable, long enough to reach floor-standing CPUs.

**Packard Bell PB8505MG**

List Price: \$229

Requires: VGA adapter with 15-pin connector

Diagonal Screen Size: 11½ inches

CIRCLE 626 ON READER SERVICE CARD



The Packard Bell PB8505MG has minor bowing on both sides of the screen image, but otherwise it is fine, if pricey, for text- or number-based applications. A combination of dark tinting and chemical etching is not enough for effective glare protection.

have attached cables with 15-pin connectors, though their cable lengths differ, and both have integral tilt/swivel bases.

**PACKARD BELL PB8503MG**

The less expensive PB8503MG has a 63-inch cable—a reasonable length for reaching a CPU that's standing on the floor. The PB8503MG's base tilts 20 degrees and swivels an ample 180 degrees, fine for pushing your monitor around to show to someone at an adjacent desk or chair, but not enough to show it to someone sitting in front of your desk without moving the whole monitor.

The PB8503MG can receive either analog or separately synchronized video input signals, but its connector requires either a 15-pin plug or an adapter. The maximum resolution is 640 by 480.

The PB8503MG didn't discriminate clearly among the bars in our VGA Color

Bars test, leaving several groups either all white or all black. Worse still, the full-screen image was lower on the right side of the screen. With no user control to straighten the image out, one must lean to the right to keep aligned with the screen, an unacceptable situation. The VGA Line Patterns test image was also fuzzy.

The PB8503MG's power switch, as well as its brightness and contrast controls, are located on the right side of the case.

**PACKARD BELL PB8505MG**

The \$299 PB8505MG has a more limited 90-degree swivel base and a shorter, 41-inch video cable. The PB8505MG also receives only analog input, although that won't matter if you use standard VGA adapters. The maximum resolution here, too, is 640 by 480.

The PB8505MG has the same incomplete color bar separation set as the

PB8503MG, but it performed differently on the full-screen white-image-distortion test. The PB8505MG's image was even from left to right, but there was noticeable bowing on each side. This idiosyncrasy is less irritating than a tilted image, so this monitor is acceptable, though costly, for data-oriented applications using text and numbers. The complex graphic image was every bit as fuzzy on the PB8505MG as on the PB8503MG.

The power switch on the PB8505MG is located on the right side, with the contrast and brightness controls on the left.

Packard Bell's monochrome VGA monitors aren't competitive with units from other vendors. They cost too much for the level of shade separation and the graphics fuzziness they offer. Both also have image distortion, though in different forms. Either these models need to go back for reengineering or Packard Bell's quality control needs upgrading.

**PHILIPS CONSUMER  
ELECTRONICS CO.**

**Magnavox  
Professional VGA  
Display 7BM749**

The company many of us knew as Magnavox is now owned by Philips Consumer Electronics Company, one of the largest electronics companies in the world. Its entry in this review, however, is called the Magnavox Professional VGA Display 7BM749, obviously going for Magnavox's greater name recognition in the U.S. The 7BM749 is a fine unit at a middling price.

For \$229 you get a flat, white-text screen with very little glare, thanks to effective chemical etching. The attached 48-inch video cable has the usual 15-pin connector for VGA adapters and has a maximum 640-by-480 graphics resolution. We sure wish everyone would agree to 60-inch-minimum video cables; 48 inches is great for a desktop CPU but can be trouble if you want your system unit on the floor. Video extension cables are expensive—let's all lobby for 5- to 6-foot video cables.

On the other hand, the tilt/swivel base has a generous 180 degrees of swivel. The tilt range is the usual 20 degrees.

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MONITORS  
MONOCHROME VGA MONITORS



FACT FILE

**Magnavox Professional VGA Display 7BM749**  
Philips Consumer Electronics Co., 1 Philips Dr.,  
P.O. Box 14810, Knoxville, TN 37914-1810;  
(615) 475-0317.  
List Price: \$229  
Requires: VGA adapter with 15-pin connector.  
Diagonal Screen Size: 12 1/2 inches

CIRCLE 627 ON READER SERVICE CARD



The Magnavox Professional VGA Display 7BM749 from Philips Consumer Electronics Co. has slight bowing, but color separation is good and the images are clear. The white-on-black screen has little glare. The base swivels 180 degrees, but the short 48-inch cable is a trade-off.

**Princeton Graphics Systems Max-15**  
Princeton Graphics Systems, 1100  
Northmeadow Pkwy., Roswell, GA 30076; (404)  
475-2725, (800) 221-1490 (outside Georgia).  
List Price: \$389  
Requires: CGA, MDA, EGA, VGA, Hercules, or  
Apple Macintosh adapter with 9- or 15-pin  
connector (both cables included).  
Diagonal Screen Size: 12 1/2 inches

CIRCLE 628 ON READER SERVICE CARD



The Princeton Graphics Systems Max-15 has a 1,024- by 768-pixel maximum resolution and works with a wide variety of video adapters. This fairly expensive but extremely flexible monochrome VGA monitor is especially good if you need to share a multipurpose monitor.

HIDDEN CONTROLS

The power switch and the brightness and contrast controls are all on the bottom-right of the monitor's front; the brightness and contrast controls are located behind a little door that's more trouble than it's worth. There's nothing particularly awkward about the door, but who needs it?

The 7BM749 had fine gray-shade separation and displayed a clear image on the VGA Line Patterns test. In the full-screen test, there was a barely perceptible bowing on each side; I'm sure I wouldn't have noticed it had I not been looking carefully. For typical test applications, this factor will be meaningless if the performance of the test unit is typical.

The Magnavox Professional VGA Display 7BM749 works fine, costs just a bit

more than you'd like to pay, and is a safe choice for appropriate applications. If you need absolutely precise graphics display, maybe you should check around more.

PRINCETON GRAPHICS SYSTEMS

Princeton Graphics  
Systems Max-15

Princeton Graphics Systems is another monitor company that's been around the minicomputer scene for a while. PGS made its name in the CGA world with its highly popular CGA color monitors. Princeton's entry in the monochrome



PERFORMANCE  
TESTS: VGA  
MONOCHROME  
MONITORS

The VGA monochrome monitor you select must resist glare from your office's ambient light in addition to displaying gray shades distinctly. In the Monitor Glare tests, the Editor's Choice TVM MG-11 proved best at withstanding glare from desk-lamp and ceiling lights.

None of the monochrome VGA monitors tested showed an exceptional resistance to the type of glare you might expect from windows positioned behind your monitor, although CTX, Magnavox, and Princeton Graphics were the best in the 90 Degrees test. Likewise, the results on the 45 Degrees test indicate little variation in the way they handled desk-lamp light. All of the monitors gave a strong showing on the 30 Degrees (ceiling light) test—with the TVM MG-11 and MG-14 and the Datafox DF-14S2 leading the field.

High scores on the white-level intensity (small- and large-square) tests indicate a wide degree of adjustability (contrast and brightness), with monitors like the TVM MG-11, the Quimax, the Compaq, and the Magnavox leading the group. Less impressive were such monitors as the two Packard Bell units, the Epson, and the Tatung, each of which offers barely acceptable brightness and contrast controls.

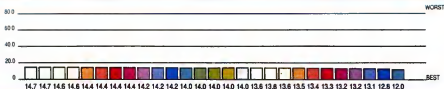
PC Labs tested the monochrome VGA monitors for monitor surface reflectivity, monitor glare, and white-level intensity using an IBM PS/2 Model 70 A21 with its integrated VGA circuitry.

## MONOCHROME VGA MONITORS

### MONITOR GLARE TESTS

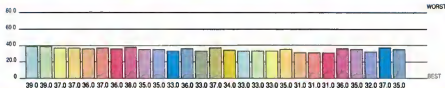
### Zero Distance

Percentage of Light Reflected



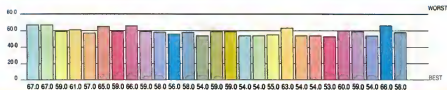
## 30 Degrees

Percentage of Light Reflected



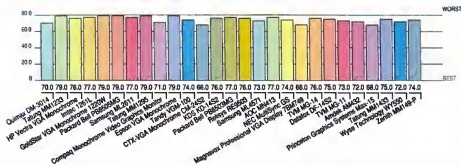
### 45 Degrees

Percentage of Light Reflected



### 90 Degrees

Percentage of Light Reflected



To measure monitor surface reflectivity, the **Zero Distance** test takes a reading of reflected light using a reflecting densitometer placed directly on the screen surface. The results are indicative of the screen's reflectivity when the effects of screen curvature are eliminated. A lower score indicates that less light is reflected from the screen's surface.

The **30 Degrees** test places a diffused spotlight at a 30-degree angle to the monitor screen to simulate the glare from office ceiling lamps. The percentage of the original light energy that bounces back off the screen is measured with a spot meter. Lower readings indicate less monitor glare.

The **45 Degrees** test places a diffused spotlight at a 45-degree angle to the monitor screen to simulate the glare from a desk lamp. The percentage of the original light energy that bounces back off the screen is measured with a spot meter. Lower readings indicate less monitor glare.

The **90 Degrees** test places a diffused spotlight at a 90-degree angle to the monitor screen to simulate the glare from direct lighting, such as that coming from a window. The percentage of the original light energy that bounces back off the screen is measured with a spot meter. Lower readings indicate less monitor glare.

CONTINUES

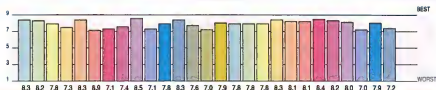


**PERFORMANCE TESTS: VGA MONOCHROME MONITORS** CONTINUED

**WHITE-LEVEL INTENSITY TESTS**

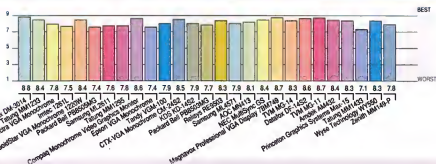
**Small-Square**

Relative Brightness (black = 1)



**Large-Square**

Relative Brightness (black = 1)



The **Small-Square** test uses the BASIC language SCREEN and VIEW commands to create a small white square defined by the screen coordinates 160,120 and 475,359. A spot meter measures the light intensity of the white square and of the black background; the background is then assigned a value of 1, and the relative brightness of the square is calculated. Higher numbers indicate a wider range of contrast.

The **Large-Square** test uses the BASIC language SCREEN and VIEW commands to create a large white square defined by the screen coordinates 0,0 and 639,479. A spot meter measures the light intensity of the white square and of the black background; the background is then assigned a value of 1, and the relative brightness of the square is calculated. Higher numbers indicate a wider range of contrast.

ENDS

VGA market is extremely flexible, but at \$389 it's not cheap.

The Max-15 is a multiscanning white-screen monitor with a maximum graphics resolution of 1,024 by 768. It has a good 270 degrees of swivel, two 73-inch video cables (one each for 9-pin and 15-pin video adapters), and lots of controls. The Max-15 works with almost every kind of video adapter, including CGA, MDA, EGA, VGA, Hercules (though Princeton doesn't recommend it), and Apple Macintosh. There's even a single-pin input for a composite RCA jack.

Controls include horizontal and vertical position and size, reverse and normal switches, and over- and underscan for different image sizes.

**THE HITCH**

All of the above sounds very good, and there's even a chemically etched screen that does a good job of cutting down on glare. One drawback with the Max-15, however, is its use of long-persistence phosphors, which cause slow image fade. Relatively slow fade is good for displaying steady-seeming alphanumeric characters, but it can drive you crazy with applications that move the screen contents a lot. The fade on the Max-15 is too slow for my taste—at times even scrolling lines in a text application left screen ghosts. The Max-15 distorted the image on our full-screen white-image-distortion test, with minor folding in both the upper corners.

The color separation was very good,

with the shade boxes clearly differentiated. The VGA Line Patterns test image was also very clear.

The first Max-15 we looked at had several problems, including a keystone screen image, poor shade separation, and fuzzy images. These problems were so extreme that we called Princeton for a second monitor, which gave the results described in this review.

In sum, the Max-15 offers good performance overall, with an excellent array of adapter, cabling, and graphics standards to choose from. This monitor will be especially appropriate if you have a variety of computers or display adapters in your organization and want one or more monochrome VGA monitors that can be shared.



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**Generic**  
SOFTWARE



QUIMAX SYSTEMS INC.

Quimax DM-3014

The main reason most people purchase computer components with little-known brand names is to save money. Quimax Systems' \$250 Quimax DM-3014 monochrome VGA monitor is a fine unit, but someone forgot to tell the company how to price it. It should be less expensive, by at least \$75, in order to be competitive.

The Quimax DM-3014 performed perfectly, with no image distortion, great shade separation, and a very clear image on the VGA Line Patterns test. The nondetachable analog video cable with 15-pin VGA adapter connector is a healthy 66 inches long. The DM-3014 works only with VGA adapters and has a 640 by 480 maximum resolution in graphics mode. The monitor's base tilts by about 20 degrees and swivels an unusual but fine 150 degrees.

Quimax has the screen controls in an odd location: the power switch and the brightness and contrast controls are under the bottom-front edge of the monitor. The brightness and contrast controls both use slide switches. The chemical etching used for glare protection is fairly effective, though there was some noticeable glare. The text-mode color is white on a black background.

The Quimax is a good monitor that does what it should. With a healthy price cut, it would be sure to give the competition a good challenge.

RELISYS

Relisys RE9503

The \$245 Relisys RE9503 is a 14-inch flat-screen monitor with a mixture of pretty good news and somewhat bad news. The good news is extra screen controls; the bad news is that they're hard to adjust while watching the screen. More good news is a lack of detectable distortion in the full-screen white-image-distortion test. More bad news is that in the VGA Color Bars test, several groups of shade boxes are not differentiated adequately. And neither conclusion can be reached regarding PC Labs' Monitor Glare Tests, where the Relisys model scored in the middle of the pack.



FACT FILE

Quimax DM-3014

Quimax Systems Inc., 844 Del Ray Ave., Sunnyvale, CA 94086; (800) 232-8282; (800) 228-0530 (outside Calif.).

List Price: \$250

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 13 1/4 inches

CIRCLE 629 ON READER SERVICE CARD



The Quimax DM-3014 offers very good performance with especially nice resolution. The 66-inch-long nondetachable analog video cable is generous; the base's 20-degree tilt range is typical, while the 150-degree swivel is unusual but adequate.

Relisys RE9503

Relisys, 320 S. Milpitas Blvd., Milpitas, CA 95035; (408) 945-9000.

List Price: \$245

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 1/4 inches

CIRCLE 630 ON READER SERVICE CARD



The Relisys RE9503 is an adequate monochrome VGA monitor, but its gray-scale shade separation isn't quite up to the competition. There are several beneficial yet awkward controls on the rear of the case.

The RE9503's 71-inch nondetachable video cable with 15-pin VGA adapter is a great length for attaching to a computer system unit placed beside a desk. The screen is tinted, not etched, but the resulting effect on glare is about the same as with the etched screens; in normal office use, there's little noticeable glare.

VARIETY OF CONTROLS

In addition to the Relisys' front-mounted brightness and contrast controls, there are also controls for vertical size and hold and horizontal position on the back of the monitor case. The problem here is that the controls are recessed about 1/2 inch inside the case and are adjusted by inserting a narrow screwdriver into the holes in the case.

The controls themselves feel as if they use rubber stems, because if you push too hard (which doesn't take much) they move to the side and you lose your grip. Because of the care you must take to adjust the

screen from the back, it's difficult to calibrate the display while watching the screen from the front. You have to either use a mirror or realize that the monitor's extra controls aren't intended for casual use and aren't usually necessary for analog monitors anyway.

There is a tilt/swivel base with a good 180 degrees of swivel and a better-than-average 25 degrees of tilting.

Maximum resolution with the RE9503 is 640 by 480 in graphics mode; with the 15-pin connector, this monitor is VGA-adapter compatible only. In general, the image is very good, but the lack of a full color (read: gray-scale) set indicates a slight graphics incompatibility, which isn't acceptable for this product's relatively high \$245 price.

The Relisys RE9503 is adequate for many purposes but is not recommended for applications requiring complex graphics and shade separation.

SAMSUNG ELECTRONICS  
AMERICA INC.

## Samsung ML2611 Samsung ML4571

Samsung has two fine monochrome VGA offerings for you. You can choose the smaller-screen ML2611 for \$189 or the larger ML4571 for \$229. Both perform well and have the normal assortment of controls, features, and functions. No apologies are necessary here: these are both good display devices.

The ML2611 and ML4571 both have permanently attached 62-inch video cables with 15-pin connectors for VGA adapters only. The maximum resolution for both monitors is 640 by 480.

No apologies are  
necessary for either  
of the two Samsung  
monochrome VGA  
models: these are both  
good display devices  
with the usual  
assortment of features.

Both models come with controls only for brightness and contrast, and those, along with the power switch, are located on the bottom of the right side of the monitor case. The etched screens display white text on black backgrounds and have reasonably good glare protection. Both models also have built-in tilt/swivel bases with 20 degrees of tilting and 180 degrees of swivel.

The only difference between the two Samsung monitors we tested, other than size and price, is a slight variation on the performance tests that had nothing to do with actual image quality.

### SAMSUNG ML 2611

On the full-screen white-image-distortion test, the ML2611 had no discernible bow-

by Winn L. Rosch

The connection between your VGA display adapter and monitor is smart—by using special signals, it tells your PC whether a color or monochrome VGA monitor is attached. Sometimes it can be too smart, however, and prevent you from using familiar software.

Although a monochrome VGA display system is fully capable of running CGA, EGA, and VGA graphics, an occasional graphics program won't run on monochrome VGA systems. If you ever face a blank screen or an error message like "Program requires a graphics adapter," you're the victim of such an incompatibility. But you can fight back with a couple of quick tricks.

### ROOT OF THE PROBLEM

The refusal of some monochrome VGA systems to run graphics applications is a result of some graphics programs' relying on an old-fashioned method of checking whether you have a monochrome or color display adapter. The program checks a special equipment flag in your computer's memory, located at absolute memory location 0000:0463 (hexadecimal).

A value of 0B4 (hex) at this location indicates that a monochrome display is active; 0D4 (hex) indicates a color display. These numbers correspond to the least significant byte of base addresses of the registers of the video controller chips on IBM's MDA and CGA video boards, which are 03B4 (hex) and 03D4 (hex), respectively.

When a program relies on the value that this flag waves, it's certain to run into problems with a monochrome VGA system. Although new monochrome display systems (such as VGA) are graphics-ready, they still run the same monochrome flag up the pole as did the original nongraphics MDA. As a result, older graphics applications see the monochrome flag and assume that they cannot run, even though the equipment would allow them to. The problem can be particularly baffling because more-recent graphics software—designed and written with full understand-

ing of the VGA system—will execute without a hitch.

Newer display systems add extra BIOS code to your computer containing a dedicated function that programs can use to directly determine what kind of display equipment is installed in your system. IBM's PS/2 series VGA systems, for example, include a specific function call—Interrupt 10 (hex), function 1A (hex)—which will inform programs of both the type of monitor and display adapter connected. Of course, for this feature to be useful, programs must be specifically written to take advantage of it. Older programs, unaware of exotic new hardware or even the new function call, cannot avail themselves of its aid.

### TWO OPTIONS

You have two options for working around this color/monochrome dissonance. One is simple and will work with most programs—the DOS program MODE.COM will change the value stored in the display adapter flag. Executing the command MODE CO80 at the DOS prompt will tell your system to load the value for a color display into the flag. If a program with graphics refuses to run on your monochrome display, try executing this command before running the application.

To return to normal monochrome operation when your backward-thinking graphics application is done, simply type MODE MONO.

Of course, the simple, software-only scheme has some shortcomings. If you don't have a truly hardware-compatible VGA display adapter, when you change the video mode (if the program will let you) you might not see anything on the screen because your software will be trying to use a video adapter you don't have.

Worse yet, some programs (several games among them) persist in isolating you from DOS, denying access to the MODE command. But you can outsmart these programs as well as the IBM display-type detection system by making a special adapter for your



## VIDEO THOUGHT CONTROL

Wire up this adapter cable and switch, and you can control whether your system thinks you have a monochrome or color VGA display; only six conductors are required, even though VGA connectors have room for 15. Two pins—11 and 12 on the display adapter side of the cable—are used for coding whether you have a color or monochrome display. When pin 11 is connected to a digital ground (conveniently available on pin 10), your system will assume you have a color display. When pin 12 is grounded instead, your system will think you have a monochrome VGA display. Attach a switch to these pins as shown, and you'll be in charge of what kind of display your computer thinks is attached.



A smart switch can compensate for dumb graphics software that doesn't know how to handle monochrome VGA.

### Display mode selector for monochrome VGA monitor cables

Video  
adapter end

Display  
end

RED VIDEO—not connected in monochrome

2

GREEN VIDEO

2

BLUE VIDEO—not connected in monochrome

RESERVED

5

GROUND for self-test function

5

RED RETURN—not connected in monochrome

7

GREEN RETURN

7

BLUE RETURN—not connected in monochrome

NO CONNECTION

10

DIGITAL GROUND

10

11

COLOR INDICATION

12

MONOCHROME INDICATION

13

HORIZONTAL SYNC

13

14

VERTICAL SYNC

14

NO CONNECTION

VGA-adapter-to-monitor cable. By changing a single connection, this adapter will make your system sense a color display instead of monochrome and load the base address of a color display register into the monitor flag area.

Once you've connected the adapter, the troublesome color programs will run, although mapping colors to monochrome may be far from optimal. Red and blue won't show, and different green tones will register as shades of gray, because only the signal wire meant for the green color gun is wired to the monochrome VGA display input.

Incidentally, don't try bridging the red, green, and blue signals together to improve monochrome color rendition when making your adapter. Remember, these are monochrome video signals, which don't add up the way you might think. Generally, the stronger signal prevails. Bridging together the signals also holds the potential of damaging your video adapter.

Besides enabling your monochrome display to run color software, this adapter can make your system think a color display is monochrome (I don't know why you'd want it to, however). Add a switch, and you—not some gray-flannel standard—can determine what your computer thinks.

Note that the video base address is loaded into the display flag area only when your system boots or when you execute the MODE command to change displays. You can't just flip the switch and assume your system will notice the change. You will have to run MODE.COM to do that.

**MONITORS**  
**MONOCHROME VGA MONITORS**



**FACT FILE**

Samsung Electronics America Inc., 301 Mayhew St., Saddlebrook, NJ 07662, (201) 587-9600.

**Samsung ML2611**

List Price: \$189

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 11 1/4 inches

CIRCLE 631 ON READER SERVICE CARD



The Samsung ML2611 is a good deal, with clear images and fine shade separation; our only complaint is the need to turn both the brightness and contrast all the way up to distinguish shade separation. You get the features you expect for the price, like a 180-degree swiveling base.

**Samsung ML4571**

List Price: \$229

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 3/4 inches

CIRCLE 632 ON READER SERVICE CARD



The Samsung ML4571 has a two-inch-larger screen than its sibling, the ML2611, and it offers the same fine performance at a \$40 premium. The ML4571 has no image distortion and separates shades of gray.

**Tandy VGM-100**

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3700.

List Price: \$199.95

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 3/4 inches

CIRCLE 633 ON READER SERVICE CARD



Here's proof that a major vendor can deliver good quality at a reasonable price. Tandy Corp.'s Tandy VGM-100 gives steady, clear images with good shade separation and a conveniently long cable. Unfortunately, there's no tilt/swivel base.

ing, folding, or other distortion. All shades of gray were also differentiated in the VGA Color Bars test, but the oddity was that, in order to clearly distinguish the shades, I had to turn the brightness and contrast controls up all the way. Otherwise images were very clear on both this and the VGA Line Patterns test.

**SAMSUNG ML4571**

The ML2611's larger sibling had the same fine performance on the distortion and VGA Color Bars test, but it didn't require boosting the brightness and contrast controls to achieve those results.

In sum, though, we'd like to see these monitors costing about \$30 to \$40 less; this would make them great bargains, as both give you what you're looking for. I'd go with the larger ML4571 just for its relatively bigger characters. But in either size, a Samsung should satisfy.

**TANDY CORP.**

**Tandy VGM-100**

It's too bad Tandy has to keep apologizing for its hobbyist image, because it sells a lot of computers to businesses. Now the company even manufactures them for DEC and Panasonic. (How's that for helping to reverse our trade-balance problem?) Tandy makes and sells lots of components, but this one, the Tandy VGM-100, is especially nice.

To start with, the price is a reasonable \$199.95. With a diagonal screen-image size of 11 1/4 inches, the tube and case are full-sized, but the unit weighs only 17 pounds. The screen color is white on black.

On both of our tests, the Tandy came through beautifully. On the VGA Color Bars test, all of the shades of gray were clearly differentiated and there was no visible bowing, folding, or other problem on the full-screen white-image-distortion test. The VGA Line Patterns test image was very sharp and steady.

The VGM-100 comes with a 72-inch video cable with a 15-pin connector for a VGA adapter, the only adapter type supported by this model. The maximum resolution is the usual 640 by 480 in graphics mode. The coated screen gives good, though not outstanding, glare protection.

There is no tilt/swivel base, a drawback for some users but certainly not for all. The

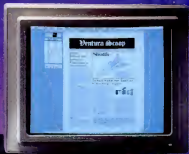
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June 13, 1989

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**CIRCLE 325 ON READER SERVICE CARD**

**MONITORS**  
**MONOCHROME VGA MONITORS**

power switch is on the right side, as are the brightness and contrast controls. There are no other user-adjustable controls.

It's nice to be able to give a recommendation without a single reservation. The Tandy VGM-100 performs beautifully, has a long cable, and is priced about right. Combine that with 18 million retail outlets for service, and how can you lose?

**TATUNG CO. OF AMERICA INC.**

**Tatung MM1233**

**Tatung MM1433**

**Tatung MM1295**

Tatung has the widest choice of monochrome VGA monitors of all the vendors we looked at in this review. Tatung sells two conventional fixed-frequency monitors—the MM1233 for \$199 and the MM1433 for \$249—and one multifrequency (a.k.a. multisynchronous or multiscanning) unit—the MM1295, which sells for \$289.

All three monitors have white-on-black screens, a base with 20 degrees of tilt and 90 degrees of swivel, and an effective glare-prevention combination of dark tinting and chemical etching. On each monitor, the power switch is on the right side and the brightness and contrast controls are on the left side of the case.

The MM1233 and MM1433 are adequate choices, but the MM1295 holds the distinction of being the least expensive of the multiscanning monochrome VGA monitors we looked at.

**TATUNG MM1233**

At \$199, the Tatung MM1233 is at the price midpoint for fixed-frequency monitors. The MM1233 has a short, 41-inch video cable with a 15-pin connector that works with VGA adapters only. The unit's maximum graphics-mode resolution is 640 by 480.

The MM1233 did fine on the full-screen white-image-distortion test, with no perceptible problems. It didn't fare as well on the VGA Color Bars test, however, with several groups of color (shades) bars not differentiated; instead, they displayed all white or all black. As a result, the VGA Line Patterns test graphic was fuzzy as well, which is an unacceptable feature at any price.

**PC MAGAZINE FACT FILE**

Tatung Co. of America Inc., 2850 El Presidio St., Long Beach, CA 90810; (800) 421-2929, (213) 979-7055, ext. 210.

**Tatung MM1233**

List Price: \$199

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 11 1/4 inches

**CIRCLE 634 ON READER SERVICE CARD**



The Tatung MM1233, a conventional fixed-frequency monitor, is best for text- and number-based applications. The unit, which has a maximum graphics-mode resolution of 640 by 480, includes a short 41-inch video cable with a 15-pin connector.

**Tatung MM1433**

List Price: \$249

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 11 1/4 inches

**CIRCLE 635 ON READER SERVICE CARD**



Like its smaller sibling, the MM1233, the Tatung MM1433 is best for applications that don't require high levels of graphics resolution. The dark-tinted and chemical-etched screen produces pleasant soft white characters.

**Tatung MM1295**

List Price: \$289

Requires: EGA or VGA adapter with 9- or 15-pin connector.

Diagonal Screen Size: 11 inches

**CIRCLE 636 ON READER SERVICE CARD**



The Tatung MM1295 has 800 by 600 resolution and is a strong competitor in the multifrequency monitor race. This is the Tatung to buy if you need high-level graphics; it produces exceptionally clear images and good shade separation.



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 4524 □ DIR+ 3.02 ..... 49.  
**Bridgeview Publishing ... NCP**  
 4386 □ FastTrax 3.9 ..... 35.  
**Broderbund ... CP**  
 1434 □ Print Shop 2.41 ..... 39.  
 1433 □ Memory Mate 3.01R (NCP) ..... 45.  
**Central Point ... NCP**  
 5039 □ PC Tools Deluxe 5.5 (new version) ..... 79.  
 5038 □ Copy II PC 5.0 ..... 27.  
**Chronos Software ... NCP**  
 4387 □ Who's What & When 1.09 ..... 119.  
**Computer Associates ... NCP**  
 4934 □ SuperCalc 5 1.0 ..... 319.  
**Crosstalk Communications ... NCP**  
 2911 □ Remote 1.1 ..... 95.  
 2908 □ Crosstalk XVI 3.7 ..... 95.  
 2909 □ Crosstalk MK. 4.1 ..... 124.  
**Dac Software ... NCP**  
 1754 □ Dac Easy Light 1.0 ..... 45.  
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**Data Storm ... NCP**  
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**Deirina Technology ... NCP**  
 4325 □ PerFORM 2.0 (new version) ..... 179.  
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 3950 □ Fastback Plus 2.09 ..... 109.  
**Fox Software ... NCP**  
 2233 □ Foxbase Plus 2.1 (single user) ..... 209.  
**Funk Software ... NCP**  
 5228 □ Sideways 3.21 ..... 42.  
 2229 □ Worksheet Utilities 1.0 ..... 59.  
 4479 □ Allways 1.0 ..... 85.  
 5157 □ Allways for Symphony 1.0 ..... 85.  
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- 4584 □ CADD Starter Kit 1.0 (incl. Level 2) ..... 109.  
 2265 □ Generic CADD Level 3 1.1 ..... 179.  
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 2295 □ Smartcom III 1.0 ..... 149.  
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 2408 □ Professor DOS 2.51 ..... 27.  
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**Microlytics ... NCP**  
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4924	Super PC-Kwik 3.2	49.
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2970	Clipper (Summer '87)	429.
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3004	Graph-in-the-Box 2.2	75.
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3221	Expanded Memory Mgr. 386 4.2	39.
3220	DESQView 2.24	39.
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<b>Reference Software ... NCP</b>		
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<b>Samna ... NCP</b>		
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3542	Software Carousel 3.0	49.
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3412	Grandview 1.0	189.
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3727	DeskLink 2.21	99.
<b>True BASIC, Inc. ... NCP</b>		
3561	True BASIC 2.1	52.
<b>Vericomp ... NCP</b>		
3765	SoftBytes 2.0	35.
<b>WordPerfect Corp. ... NCP</b>		
3799	WordPerfect Library 2.0	89.
3798	WordPerfect Executive 1.0	129.
3804	WordPerfect 5.0	239.
3805	WordPerfect Network 5.0	349.
3806	Additional Network Stations 5.0	84.
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5000	Upgrade to Release 5.5	89.

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XTREE Pro 1.1 .....	69.
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XYWrite III Plus 3.55 .....	229.

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Where in the World is Carmen Sandiego? .....	25.
Where in the USA is Carmen Sandiego? .....	25.
Where in Europe is Carmen Sandiego? .....	29.
JetFighter (by Velocity) .....	35.
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Dinosaur Discovery Kit (First Byte) .....	29.
Might & Magic II (New World) .....	32.
Earl Weaver Baseball 1.5 .....	32.
Hillstar (from SSJ) .....	32.
Attack Sub .....	35.
<b>Microprose ... CP</b>	
IF-19 Stealth Fighter .....	39.
IF-15 Strike Eagle .....	22.
<b>Microsoft ... NCP</b>	
Flight Simulator 3.0 .....	35.
<b>Mindscape ... CP</b>	
Gauntlet .....	29.
Colony (3 1/2" not available) .....	33.
Balance of Power 1990 .....	33.
<b>Parlor Software ... CP</b>	
Bridge Parlor 2.3 .....	49.
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Leisure Suit Larry II .....	33.
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Manhunter .....	33.
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Up Periscope .....	25.
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Kemeny/Kurtz Math Series each module .....	29.



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SixPakPlus 64k C/SP .....	129.
RAMPage Plus 286 512k .....	419.
RAMPage Plus MicroChannel 512k .....	469.
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3-Position switch box .....	39.
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Curtis Clip CC-1 .....	6.
Disk Holder DB-1 .....	8.
3 1/2" Disk Holder DB-2 .....	8.
Printer Stand PS-1 .....	18.
Filtered SafeStrip SPF-3 .....	24.
Universal System Stand SS-3 .....	25.
Emerald SP-2 .....	36.

<b>1707 Ruby SPF-2</b> (6 outlets; EMI/RFI filtered; 6 ft cord) .....	\$55.
<b>1708 Ruby-Plus SPF-2 Plus</b> (w/FAX & modem protection) .....	69.
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Irma 2 (3270 emulation board) .....	729.
<b>1764 Irma 2 Micro Channel</b> .....	729.
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<b>1904 FX-1050</b> (136 col., 264 cps, 9 pin) .....	call
<b>5183 LO-510</b> (80 col., 180 cps, 24 pin) .....	349.
<b>1930 LO-850</b> (80 col., 264 cps, 24 pin) .....	call
<b>4117 LO-950</b> (110 col., 220 cps, 24 pin) .....	call
<b>1917 LO-1050</b> (136 col., 264 cps, 24 pin) .....	call
<b>4116 LO-2550</b> (136 col., 333 cps, 24 pin) .....	call
<b>5184 LX-810</b> (80 col., 180 cps, 9 pin) .....	199.
<b>1052 Printer-to-IBM cable</b> (6 feet) .....	15.
<b>Everex ... 1 year</b>	
1200 Baud Internal Modem .....	79.
2400 Baud Internal Modem .....	149.
<b>5th Generation ... 1 year</b>	
Logical Connection 512k .....	529.
Logical Connection 1 Meg .....	749.
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Personal Modem 1200 (with Smartcom EZ, 1 year warranty) .....	145.
<b>2304 Smartmodem 1200</b> .....	289.
<b>2305 Smartmodem 1200B</b> (w/Smartcom II) .....	289.
<b>2306 Smartmodem 1200B</b> (hardware only) .....	259.
<b>2307 Smartmodem 2400</b> .....	429.
<b>2308 Smartmodem 2400B</b> (w/Smartcom II) .....	429.
<b>2309 Smartmodem 2400B</b> (hardware only) .....	399.
<b>Hercules ... 2 years</b>	
Graphics Card Plus .....	189.
VGA Card .....	189.
<b>Intel ... 5 years</b>	
4896 2400B Internal Modem .....	159.
2352 2400B Internal Modem 2 (for PS/2) .....	249.
5119 2400 Baud External Modem .....	179.
2346 Inboard 386/PC w/1 Meg .....	599.
4646 Inboard 386/PC Piggyback 4 Meg .....	1249.
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2370	80287-8 (for 8 MHz 80286 CPU's)	219.
2369	80287-10 (for PS/2 Models 50 & 60)	259.
4750	80387SX (for 80386SX CPU's)	359.
2371	80387 (for 16 MHz 80386 CPU's)	399.
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4972	Powerfree 10	19.
4973	Powerfree 20	29.
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4675	GM6000 Mouse (350-1050 dpi)	59.
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4388	ClearCase Mouse (serial only)	89.
5151	New HiREZ Mouse (C9)	89.
5152	Mouse w/Paint Show (C9)	99.
4297	ScanMan (hand held scanner)	219.
<b>Magnavox ... 2 years</b>		
5051	VGA Adapter (9A1610)	259.
4758	13" CGA Monitor (8CM1515)	269.
4760	13" Hi-Res Monitor (9CM053)	369.
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2886	Mach 20 Disk Plus Option (floppy controller)	69.
2887	Mach 20 Memory Plus Option (512k upgradeable to 3.5 Meg)	339.
2897	Mouse with Paintbrush	109.
2896	Mouse with EasyCAD	125.
2898	Mouse with Windows 286 2.1	139.
<b>Mouse Systems ... lifetimes</b>		
2812	OrnnMouse (serial only; 1 year wrty)	39.
4306	PC Mouse II w/PC Paint+	89.
4305	PC Mouse II w/Amosketch	105.
<b>NEC ... 2 years</b>		
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5085	Multisync 3-D Monitor	699.
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4765	Designer 800 VGA (360 x 480)	249.
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3200	Silencer 150 (84% noise reduction)	115.
3201	Silencer 200 (69% noise reduction)	149.
4514	Turbo Cool 375	299.
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3103	2400 Baud Internal Modem (with PROCOMM)	139.
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5285	2400 Baud External MNP Modem (Level 5)	209.
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4562	Safe 425W (standby power bkup)	369.
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5111	SOTA 286-12 (12 MHz accelerator)	299.
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4899	Nylon Laptop carrying case	55.
4901	Leather Laptop carrying case	139.
<b>TheComplete PC ... 2 years</b>		
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4885	TheComplete Answering Machine	219.
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4276 20 Meg Cartridge Tipak (5 1/4")	269.
5113 44 Meg Cartridge Tipak (5 1/4")	159.
2499 PC2 Card	169.
2500 PC2B Card (bootable card for PC/XT/AT)	229.
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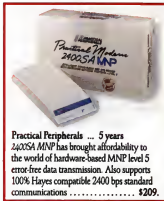
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# PC CONNECTION



## MONITORS

### MONOCHROME VGA MONITORS

If you're using a screen only for data, word processing, or spreadsheet applications, the MMI233 is fine, but it's not a good choice for applications requiring high-resolution graphics.

#### TATUNG MM1433

The MM1433 is generally similar to the MM1233, with a few exceptions. First of all, it costs \$50 more (\$249, to be exact). The MM1433 is also 2 inches bigger than the MM1233, with a nominal 14-inch screen size.

The other differences are a 2-inch-longer cable (still short at 43 inches), a rear-mounted horizontal-position control, and a reverse/normal switch—also on the back—that swaps screen foreground and background colors.

The MM1433 performs just like the MM1233, with less-than-perfect shade separation but good results on the distortion test. This monitor too is fine for data, poor for graphics. The model also performed well across three out of four of PC Labs' Monitor Glare Tests.

#### TATUNG MM1295

The MM1295 is the Tatung to consider if you want VGA quality and will be working with graphics. With a maximum resolution of 800 by 600 (sometimes called Super VGA), the MM1295 has a higher top end than the other models. And as mentioned, the MM1295 is also the least expensive multiscanning monitor that we looked at.

Besides offering higher resolution, the MM1295 had very clear separation in the VGA Color Bars test and a resulting clear hi-res complex-graphic image. There was no distortion on the full-screen white-image-distortion test.

The MM1295 comes with two cables, a 9-pin and a 15-pin, each 60 inches long. The MM1295 can work with both EGA and VGA adapter cards, widening its application possibilities.

#### THE BOTTOM LINE

The two conventional, fixed-frequency Tatung monitors, the MM1233 and MM1433, are only OK because of their shade separation limitations and are outperformed by several less-expensive competitors. The Tatung MM1295, however, would prove itself a much better choice. At \$289, the MM1295 costs less than the NEC, TVM, or Princeton Graphics Systems monitors and will still display up to Super VGA resolution.



#### FACT FILE

TVM Professional Monitor Corp., 1109 W. 9th St., Upland, CA 91786; (714) 985-4788.

#### TVM MG-14

List Price: \$249

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12¾ inches

CIRCLE 637 ON READER SERVICE CARD



The TVM MG-14 offers very good glare protection, courtesy of its dark tinting and chemical etching. Standard controls for brightness and contrast are on the left side, while a horizontal phase control (which moves the image from left to right) is located on the back of the unit.

#### EDITOR'S CHOICE

#### TVM MG-11

List Price: \$349

Requires: VGA or EGA adapter with 9- or 15-pin connector.

Diagonal Screen Size: 12¾ inches

CIRCLE 638 ON READER SERVICE CARD



The TVM MG-11 is an attention-getting multisynchronous unit with great performance and 1,024 by 768 maximum resolution. There's a great deal to like in this monitor, with its screen image controls, both 9- and 15-pin video cables, and compatibility with Macintosh video adapters.

#### TVM PROFESSIONAL MONITOR CORP.

### TVM MG-14 TVM MG-11

TVM makes two varieties of VGA monochrome monitor: the standard analog TVM MG-14, costing \$249, and the multiscanning TVM MG-11, costing \$349. Both use 14-inch (diagonal measure) screens and have actual image sizes of approximately 11 inches. Based on the features and performance in our testing, the more expensive TVM MG-11 is the better buy of the two—based on not only features but also PC Labs' tests for image distortion and glare resistance.

#### TVM MG-14

The \$249 MG-14 is at the top of the price range for straight analog monitors. Unfortunately, the unit doesn't perform at the top level.

The paper-white MG-14 did a fine job on the full-screen white-image-distortion test, producing nice, straight lines and edges. On the VGA Color Bars test, however, there were several groups of bars that weren't separated; they were displayed as either all black or all white. Partly as a result of the color-separation problem, the VGA Line Patterns test graphic, which uses many lines of different shades, looks a bit fuzzy. When you can spend half the price of this monitor (at list) and get better performance, it's hard to get too excited about the TVM MG-14.

The tilt/swivel base moves up and



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CIRCLE 132 ON READER SERVICE CARD

### MONITORS

#### MONOCHROME VGA MONITORS



#### EDITOR'S CHOICE

- Imtec 1261L
- TVM MG-11

At first glance, it's difficult to tell one monochrome VGA display from another. As long as they can display images in 640- by 480-line resolution and provide at least some glare protection, as do all 27 monitors reviewed here, mono VGA screens are pleasant to work with. And while VGA resolution may not be the latest video standard for desktop PCs, it presently remains the high end.

Despite the similarity, two monitors stood out as the best values, based on screen performance and price, in a field populated by many winners. They are the Imtec 1261L and the TVM MG-11.

Leading Technology's Imtec 1261L is clearly the low-price winner. At \$149 list, the 1261L is the least-expensive monitor we tested. But price is not the Imtec's only claim: it also has good shade separation, clear images, and no image distortion. An above-average 62-inch cable and a 180-degree swiveling base add to the value. The Imtec 1261L is the clear price/performance star, even compared with the \$199.95 Tandy VGM-100, which also merits some consideration.

TVM Professional Monitor Corp.'s \$349 TVM MG-11 is the best deal of the multiscanning monitors we tested. The MG-11 had perfect performance, a full complement of screen-adjustment controls, and a 1,068- by 768-line maximum resolution—reassuring if you're concerned about future video standards. The MG-11 works with EGA, VGA, and even Apple Macintosh video adapters, so it's particularly appropriate if your office uses both PCs and Macs.

down 20 degrees and horizontally 90 degrees. The attached 43-inch cable is fine if you keep your monitor on top of your system unit, but it's too short if you put the box on the floor and keep the screen on the desk. In the second case, you'll need an extension. The cable has a 15-pin connec-

tor for VGA adapters only. Maximum graphics resolution is 640 by 480.

The MG-14's power switch is on the right side, and the brightness and contrast controls are on the left side. There's also a horizontal phase control (which moves the image left and right) on the back, a recessed control not often used.

The glare protection is very good on this model—TVM uses both dark tinting and chemical etching to keep down light reflection.

#### TVM MG-11

For \$100 more than the MG-14, you can step up to the MG-11, and this unit gets a hearty welcome. The MG-11 is a multiscanning monitor with a maximum resolution of 1,024 by 768, higher than its major competition, the NEC MultiSync GS, which sells for the same price.

The MG-11 has the same 20 degrees of tilt and 90 degrees of swivel as the MG-14, but the cable is not attached because the MG-11 comes with two cables: one with a 9-pin connector, the other with a 15-pin connector. Both cables are 63 inches long.

The MG-11 works with both EGA and VGA adapters and with the Apple Macintosh, adding to its flexibility. The paper-white screen uses dark tinting and chemical etching to cut down on glare.

The MG-11's power switch is on the right side, the contrast and brightness controls on the left. In the back of the case is a full complement of controls for vertical position, vertical size, horizontal position, and both vertical and horizontal hold. There's also a selector to choose between four levels of shade contrast.

The MG-11 did a terrific job on the display tests. On the VGA Color Bars test, the gray shades were very distinct, which also added to the sharpness of the VGA Line Patterns test image. As with the MG-14, there was no perceptible distortion on the full-screen white-image-distortion test.

Based on price, resolution, and performance, the TVM MG-11 is the top multiscanning VGA monitor we tested.

If you're looking for a standard analog monochrome VGA monitor, the TVM MG-14 doesn't perform well enough to warrant a recommendation. The TVM MG-11, however, is an excellent choice, priced competitively and leading the pack in resolution and display performance. The MG-11 has both 9- and 15-pin video cables, and its maximum resolution gives you the security of being ready for video adapters at least a few steps into the future.

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## WYSE TECHNOLOGY

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WY550

Wyse Technology is a major microcomputer vendor whose name is on the inside of more components than you'd probably expect. Wyse resells many computer components under other vendors' names. And, of course, Wyse is known as a terminal and computer vendor in its own right. Wyse's WY550 is its \$249 monochrome VGA monitor.

The WY550, available with either an amber or a paper-white screen, is a VGA-adaptor-only monitor with 640-by-480 maximum graphics resolution. The video cable is a short 45 inches in length, with a 15-pin connector at the computer end. The cable is nondetachable. All controls are on the right side of the case—the power supply switch (an unusual push button) and the brightness and contrast controls, both of which are rather loose-feeling rollers.

The Wyse has terrific resolution; a stable, clear image; and hardly any glare. The low glare from this screen indicates that not all chemical etching is alike (chemical etching is the glare-resistance technology that most of the vendors reviewed use). The Wyse base tilts 20 degrees and swivels an ample 270 degrees.

The WY550's clear images are helped by precise shade separation, although there was slight folding in all four corners in our full-screen white-image-distortion test.

The WY550 isn't a big threat to other vendors at its \$249 price, but most Wyse monitors are sold with systems. Most are probably used for text-based applications, where the clear, steady images are just the ticket.

## ZENITH DATA SYSTEMS

## Zenith MM149-P

Zenith builds great computer monitors. In the early microcomputer days, the Zenith monochrome composite monitors were very popular, and today the Zenith ZCM-1490 flat-tension color monitor is considered one of the best PC-level monitors on the market. The only monitor Zenith generally sells separately from computer sys-



## FACT FILE

## Wyse Technology WY550

Wyse Technology, 3571 N. 1st St., San Jose, CA 95134; (408) 433-1000, (800) GET-WYSE.

List Price: \$249

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 13 inches

CIRCLE 639 ON READER SERVICE CARD



The Wyse Technology WY550 has clear resolution, a rock-steady image, and adequate glare protection, plus a 270-degree base swivel. The only complaints are slight image folding in each corner on our full-screen white-image-distortion test and a relatively short, 45-inch cable.

## Zenith MM149-P

Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (312) 699-4800.

List Price: \$299

Requires: VGA adapter with 15-pin connector.

Diagonal Screen Size: 12 3/4 inches

CIRCLE 640 ON READER SERVICE CARD



An excellent performer, the Zenith MM149-P has a 72-inch cable and a full complement of adjustment controls. No tilt/swivel base comes standard—it's a \$25 option. This model is on the high-priced side but is usually sold as a part of a computer system and discounted significantly.

tems is the flat-tension color VGA screen. Virtually all of its other monitors are sold with computers.

Notwithstanding the real-world distribution of Zenith monitors, the Zenith MM149-P is a beautiful performer. The downside is that the list price is \$299, but remember that hardly anyone ever buys the monitor alone; it's usually included in a full system that's heavily discounted. You can buy an MM149-P by itself from a Zenith dealer, but expect the dealer to be surprised if you ask. If you get one, you'd better hope for a hefty discount—\$299 is a lot to spend.

The MM149-P ("P" is for paper white; an "A" model with an amber screen is also available) has a maximum resolution of 640 by 480 and works only on analog input from a VGA video adapter.

The MM149-P's attached 72-inch video cable has a 15-pin connector at the com-

puter end. The MM149-P has power, brightness, and contrast controls on the right side and vertical position and size and horizontal position and size controls on the back of the case. There is no tilt/swivel base on the standard version, but you can get one as an option for an extra \$25.

The Zenith had no image distortion and showed very distinct shade separation on the VGA Line Patterns test. If you stay within the standard VGA world, you probably won't find an image that this screen won't display beautifully, even though it's only monochrome.

This monitor is very popular in the education market, according to Zenith. It's too bad the company won't cut the price by a third or so; I bet they'd find it popular in the business market, as well.

Bruce Brown is a frequent contributor to PC Magazine.

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## **CompuServe**

# Project Scheduler 4

The difference is graphically clear.

Project Scheduler 4 set new industry standards for power, speed, and ease of use. Now Version 1.5 raises PC-based project management to an even higher level. In business after business, people are making the change to Project Scheduler 4. Why? The following comparisons make the reasons graphically clear.

Features	Project Scheduler 4	Time Line 3.0™
Gantt chart mode	•	•
Network chart mode	•	•
Spreadsheet mode	•	
Selectable Gantt graphics	•	
Fine grain summary Gantt charts	•	
Network chart automatic task placement	•	•
Multiple auto network draw algorithms	•	
Network chart interactive task placement	•	
Resource allocation & costing	•	•
Resource automatic time based cost inflation	•	
Resource calendars	•	
Automatic resource leveling	•	•
Interactive resource leveling	•	
Multiple project structures	•	
PERT schedule probability analysis	•	
Schedule & cost tracking	•	•
Independent multi-project support	•	
Integrated printer & plotter graphics	•	
Postscript graphics support	•	
Full data export	•	•
Full data import	•	

## Unmatched power at your fingertips.

Project Scheduler 4 offers an impressive list of industry-leading power features. Projects are planned and tracked in a full graphics environment. You understand more because you see more on the screen. At last, PERT and Gantt charts make sense. Responsibilities, deadlines,

and resource bottlenecks are spotted at a glance. You see more on paper, too. Beautiful, graphic reports print sideways, so you never have to cut and paste. They're instantly understandable. Not to mention simple to generate for impressive presentations.

Benchmark	Product	Number of tasks				
All times in seconds		100	200	300	400	500
Schedule Recalculation	Project Scheduler 4	0.8	0.9	1.0	1.1	1.2
	Time Line 3.0	10.3	22.6	372.4	1024.8	1283.6
Display Network Chart	Project Scheduler 4	1.0	1.1	1.2	1.4	1.5
	Time Line 3.0	134.5	*	*	*	*
Load Project File	Project Scheduler 4	2.7	3.8	5.7	7.7	13.5
	Time Line 3.0	18.4	32.4	84.2	180.9	244.5
Save Project File	Project Scheduler 4	3.1	4.5	5.4	5.4	8.1
	Time Line 3.0	18.1	35.8	75.0	102.4	128.0

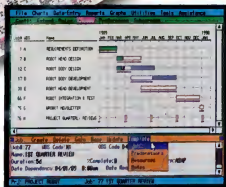
\*After computing for over 12 minutes, Time Line displayed an "Unable to display Network View" message. All benchmarks were run on a 12 MHz 286 with 640K RAM.

## Time-saving, world-class speed.

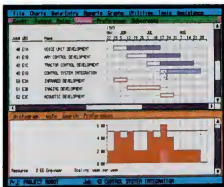
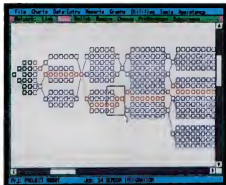
In benchmark tests, Project Scheduler 4 consistently outperforms all the competition as the fastest full-featured product in the industry — by a very wide margin. After all, what good are power features without the speed to make them useable. And the bigger your

project, the more speed counts. Even at the 1000-task level, Project Scheduler 4 takes only 1.5 seconds to perform schedule recalculation. When your time is on the line, your project scheduler should help you manage it, not waste it.

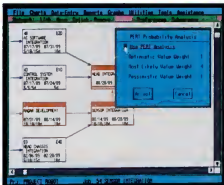




Project Scheduler 4 lets you view a Gantt chart in one window, while you enter or edit in another. Complete status information gives you a precise overview of your entire project. You control exactly what time scale is displayed: minutes, hours, days, weeks, months, or years. Display preferences include alternate symbols, free and total float, baseline, WBS and OBS filters, and much more.



In Gantt Histogram mode, a single mouse click quickly finds resource overloads and displays problem tasks. To see the planned resource utilization for a task, point at it in the Gantt chart, and the corresponding area in the histogram is automatically shaded. You may level resources interactively using Extend or Delay mode to eliminate resource overloads with a single click of the mouse.



Four reduced network zoom levels let you view the amount of detail you need to see. Each level provides drawing tools for positioning tasks in the network and changing predecessor relationships. When working with PERT analysis, Project Scheduler 4 lets you control probability weights and specify alternative task durations, while the program instantly recalculates the critical path.

Function	Project Scheduler 4	Time Line 3.0
Advanced graphical user interface	•	
On-line help	•	•
Step-by-step assist mode	•	
Pull mouse support	•	

## Exceptional ease and elegance.

Project Scheduler 4 offers sophistication that's simple to use. It's intuitive graphic interface gives you a clear overview of the entire scheduling process without hard-to-remember keystroke sequences. Ideal for beginners and experts, here is the future of advanced productivity tools.

Only Project Scheduler 4 offers the advanced graphics, high-speed performance, and ease of use you need to save time — and maximize productivity. For more information and a brochure, call or write:

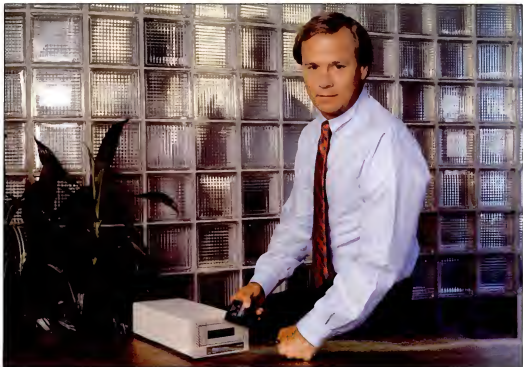
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# Backup Software


PHOTOGRAPH BY TERRY WICK

## For the Moment After

Lost files can mean your job,  
but these 15 programs  
help you survive  
the inevitable hard  
disk crash or data disaster,  
offering a variety of  
creative strategies to meet  
any backup or data  
transfer requirement.

*by Edward Mendelson*

Nothing is certain but death, taxes, and lost files. But while death permanently removes you from the earth and taxes part you from your money forever, lost files can be recovered—if you've been backing them up.

With backups, irreplaceable data can survive disasters like corrupted hard drive files, crashed disks, stolen computers, even fire and flood. If you lead a charmed life and disasters never happen to you or your data, you will still find backups useful for preserving older versions of crucial files.

You can also use backups as temporary storage for your files when updating your hard disk from an older version of DOS, or you can use them simply as a way of transferring a group of files between two computers. If a file is larger than a single floppy disk, a backup is almost always the most efficient way to move it from one computer to another—unless you're willing to tie up the phone lines for a few hours.

Most users in corporate and private offices use backup software to transfer files from hard disks of moderate size—up to 40MB—to floppy disks. When your data expands beyond 40MB, it's time to consider a tape drive so you

won't have to spend a whole afternoon feeding floppies to an insatiable backup program.

But even in the age of 600MB hard disks and gigabyte tape drives, programs that primarily back up to floppy disk drives still have their place. Provided that they're not limited to backing up to floppy disks only, they can be used in a network to let each user make a personal set of backups on floppy disks; they also can back up the user's hard disk to the hard disk in the server, then back up the files backed up to the server to a giant tape or WORM (write-once, read-mostly) drive.

#### EARLY BACKUP

Backup and restore programs for the PC began with the PC-XT in 1983 and with the 2.0 version of DOS that IBM released to support its new 10MB hard disk. In theory, DOS's BACKUP slowly copied files from a hard disk to a series of floppy disks; DOS RESTORE then restored the files to the hard disk when needed. In practice, this sequence of events occurred only if you were lucky enough to have backup disks that didn't make the restore program choke on a bad byte, as it always seemed to do when you needed your backups most.

Today's backup programs shuffle data from a hard disk to backup disks at breathtaking speeds—sometimes too fast for you to put a label on the next disk before the backup program demands it. The best of these programs combine speed and safety. A few offer more speed than security but generally come with options that let you shift the balance to the side of safety.

Some backup programs make an end run around DOS to take direct control of your computer's hardware for ultrafast transfers via the normally sluggish floppy disk controller. Some programs, for the sake of speed and data compression, deliberately create backup disks that only the backup program can read afterward. If you ask DOS to give you the directory of one of those disks, DOS will think the disk is unformatted or defective. When you want to restore files from these backups, you'll need a copy of the original backup program.

Some backup programs do use DOS-readable disks, but they save time by storing as many as a few hundred files from your hard disk in a single file on the floppy disk. This saves time that would otherwise be spent updating the directory and file allocation table on the floppy. It also saves space, because a 10-byte file doesn't have

to fill the minimum 1K that DOS normally requires for each file on a floppy disk.

The only potential danger in this system (as with the programs that create files that DOS cannot read) is that you cannot recover the files without a copy of the original backup program. And if you need to restore files because your computer was stolen, it's quite possible that the thief walked

**Today's backup programs shuffle data at breathtaking speeds—sometimes too fast for you to put a label on the next disk.**

off with your copy of the backup program, as well. You may be able to order a copy of the backup software for tomorrow, but what if you need the data today?

#### DATA COMPRESSION

With the majority of these programs, the data stored in their monster files looks like the data in the original files, so you might at least be able to use a file viewer or text editor to extract simple ASCII data from the backups. But if the backup program uses data-compression techniques (usually optional) in creating DOS-readable disks, as do *Back-It*, *COREfast*, and *Perfect Backup*, your data may be unrecognizable. However, if you're willing to accept the minuscule risks involved, these programs can save you a lot of valuable time and disks.

Several programs (including those of the ultrafast-transfer variety) subscribe to the "if it has a drive letter, back up to it" philosophy: they create DOS-readable backup files on any "DOS device." This means that anything in your system that has a drive letter allows access to DOS—hard disks, network servers, removable cartridge disks, any flavor of internal or external floppy disk drive, and some tape drives. (Tape drives that don't use drive letters can be accessed only through their own dedicated software, not

by DOS or by third-party backup programs.) About the only drive these programs can't back up to is a CD-ROM.

If you're obsessed with safety, you may want to consider one of the slower backup programs that reproduces the directory structure of your hard disk on your floppies. If you have a file on your hard disk named \DEEP\DEEPER\DEEPEST\BIGFILE.TXT, the backup program will create all of the necessary subdirectories on the floppy before copying the file itself into the lowest directory. If disaster strikes, you might very well wind up spending a few tedious hours using the DOS COPY command to restore your files to a hard disk, but at least you'll get them back. And if you need files that the backup program divided over two or more floppy disks, you may have to check the DOS manual for the syntax of the little-used function of COPY that lets you combine two or more files into one.

#### LOTS MORE THAN SPEED

If you believe everything you read in advertisements, you may suppose that backup speed is all that counts in a backup program. While speed is important, convenience counts, too. If you have a well-made hard disk, it may not fail for years. Meanwhile, you will probably use your backups to restore early versions of a report that you rewrote badly or of a spreadsheet that you ruined by entering the sales figures for widgets when you meant to enter the figures for gizmos.

With too many backup programs, you have to waste half an hour feeding every one of your backup disks into the drive until the program finds GIZMO.WK1 and restores it to the hard disk. Some programs make you insert the first or last disk of a backup set in the drive so that they can read a catalog; only then do they tell you which disk has the file you want. Many programs keep a log of the hard disk with a list of backed-up files and the numbers of the disks that have them—but then don't give you a way of reading the log.

With a few programs, you'll have to find your way to an unintuitive menu where you type in the name of the file you want and then go through a few more steps before finding out which disk to use. Only one program, *Intelligent Backup*, does what every program should do. You simply enter the name of the file you want as a command-line parameter when you run the program, and it instantly tells you which disk to insert into the drive.

## TWO BACKUP FLAVORS

Backups come in two basic flavors—*image backups* and *file-by-file backups*. Image backups reproduce every byte on a hard disk to the backup disks in exactly the same order. When you restore an image backup to a new hard disk, every byte of data ends up in exactly the same place as it was on the original disk. The trouble with this is that some of those places on the new disk may be defective sectors that DOS has cordoned off, and if your data ends up there, you have no way of using it. If part of a program lands on one of those bad sectors, it won't run. Out of the programs we reviewed, only *COREfast* offers an option to make an image backup. It's an option you should never choose.

Every other program offers only file-by-file backups: the files on your hard disk are copied *as files* to the backup disks. When you restore to another hard disk, all of the files will be intact, but they won't be in exactly the same place as they were on the original hard disk.

## START WITH FULL BACKUP

When performing file-by-file backups, you generally start with a "full backup" of every file on the disk, and then you make faster and smaller "incremental backups" of every file that you've modified or added to your disk since the preceding backup. Periodically, you will start again with another full backup and follow it with further incremental backups.

When you need to restore your hard disk, you start with the most recent full backup and follow it with the incremental backup disks. The more recently revised copies from the incremental backups will overwrite the older copies from the full backup, and your disk will be restored to the condition it was in when you last performed a backup.

The same applies even if you don't need backups of your whole disk because your program files are easily restored from the original floppy disks. In this case, you can tell your backup program to process only a limited set of files or directories. You will probably begin by backing up every file that fits your specification, then later back up every new or modified file.

How does your backup program know which files are new or modified and therefore need to be backed up during an incremental backup? The answer is the *archive bit*; though invisible to the user, it forms part of the directory entry for each file. The archive bit is like the flag on a rural mail-

box that tells the postman there's an outgoing letter inside. On your hard disk, when the flag is up (that is, when the archive bit is set from 0 to 1), it alerts the backup program that a file on the disk needs to be transferred during an incremental backup. Whenever you create or copy a file to your disk, DOS sets the archive bit as a flag to alert a backup program.

The archive bit is like the flag on a rural mailbox that tells the postman there's an outgoing letter inside.

If you've never used a backup program on your hard disk, every file will normally have the archive bit set. When a backup program copies the file, it pushes the flag back down; the file won't be backed up during the next incremental backup unless you modify it, in which case the flag goes back up again. Of course, during a full backup every file is backed up, regardless of the state of the archive bit.

If you make frequent incremental backups, you can end up with a huge stack of disks, each reflecting a different stage in the history of your files. This can serve as a valuable audit trail, but it tends to get unwieldy. You can always replace the whole stack of disks with a new full backup, but some programs let you perform a *differential backup*. During a differential backup, every file that was created or modified since the date of your last full backup is backed up in a single set.

Even when a backup program doesn't explicitly offer this option, you can often accomplish something similar by using an option that lets you back up modified files without lowering the archive flag. This effectively turns every incremental backup into a differential backup and lets you maintain only one supplementary set of disks to add to the most recent full backup.

Some backup programs—*Back-It*, *Intelligent Backup*, and *TakeTwo Man-*

*ager*—manage your backup schedule for you. They ask you to set aside a "pool" of backup floppy disks, and then, after you've made a differential backup or two, they recycle the older differential disks so that you always have a full current set. With other programs, you should consider reusing your backups in cycles. You should make a full backup of your disk once a week, until you have three complete sets. On the fourth week, overwrite the oldest set of disks with a new full backup. Even if something goes wrong while you are making the newest set, you will still have two earlier sets that you can use for recovery.

## HANDLING SPECIAL FILES

The archive bit is only one of the flags that DOS uses to identify special types of files. Others include the bits that identify files as *hidden* (which means they will not appear when you type DIR), *read-only* (which means that DOS will not delete them or allow them to be modified), or *system* (identified by a flag that normally identifies the two hidden, read-only files that must be at the very start of a given disk in order to boot from it).

Backup programs handle these special files in different ways. Most let you decide what you want to do with them. Normally, hidden and read-only files will be backed up. Some programs create hidden files because they are crucial to the program's operation and the programmer fears that you may accidentally delete them if they weren't hidden; you may also hide files yourself as a rudimentary form of security. Read-only files are often those that the program needs to run or that you want to protect from modification (except under special circumstances). Most programs will prompt you before overwriting read-only files during a restore, just in case your hard disk now has a more recent version than the one on the floppy disks.

System files are a very different kettle of bits. They come in two varieties, one benevolent and one malignant. Neither should be backed up. If your backup software gives you the option to ignore system files, use it.

The benevolent variety includes the two hidden, read-only system files without which no disk can boot. In IBM's versions of DOS these are called IBMBIO.COM and IBMDOS.COM; in Microsoft's version, IO.SYS and MSDOS.SYS; some third-party DOS vendors use different names. These files must be at the very start

of your hard disk and must be the first two files in the root directory. If your backup program were to back up and restore these files, it is likely that they would wind up in the wrong place (leaving you with a non-bootable hard disk). It could also cause you to reinstall an older version of DOS accidentally on the disk after carefully installing a new one. Some backup programs that normally back up system files are smart enough to make an exception for these special files.

Other benevolent system files include files used by undelete programs to store the exact locations of your files for later recovery. If you restore such a file to another hard disk, its data will be invalid and even dangerous in the new location.

Malevolent system files are the ones deposited on your disk by copy-protected software. If you back these up and then restore them, they'll end up at a point on the disk different from the one where they began. If the software doesn't find these files in exactly the place it expects them, it will accuse you of using an illegal copy and won't run.

Copy-protected software discourages backups and endangers your data. If you can't exterminate this kind of binary vermin because you need to use the program, then before backing up and restoring your hard disk, uninstall the copy-protected software according to the vendor's instructions, then reinstall it after restoring your other files.

#### FIFTEEN PROGRAMS TESTED

PC Labs tested 15 backup programs ranging in price from \$59 to \$189. We included only programs that were capable of splitting large files over two or more floppy disks and of backing up more than one directory at a time. If you are certain you don't need these capabilities, or if you don't need the faster speed that many of these programs give you, you can get along with careful use of DOS's XCOPY command (see the sidebar "Doing It with DOS's Own BACKUP and XCOPY"), John Dickinson's *PC Magazine* utility BAC.COM (available on PC MagNet), Tall Tree Systems' *JetDrive*, or any of a dozen free and shareware utilities available on any BBS.

We timed the performances of each program in backing up and restoring. We timed their performances in backing up to unformatted disks (forcing the programs to format disks while backing up), and we then timed their performances in backing

up to disks they had formatted themselves (in some cases with their own proprietary formats) during an earlier backup. A few years ago, programs that used proprietary formatting had a large speed advantage over those that used DOS-compatible formats. Now that advantage has evaporated. For instance, *Fastback Plus*, which uses DOS-compatible formatting, is generally as fast as or faster than the speediest programs that format disks in ways DOS can't read.

The tests included measuring the time it took to swap floppy disks in and out of the single 1.2MB drive in the AT used for the tests. If you have two matching floppy drives (not only of the same size but also of the same capacity), almost all of these programs let you save time by inserting a disk in one drive while the program backs up to the other. When the software is finished writing to one disk, it immediately switches to the other.

Almost all these programs have means of verifying that a backup was either written correctly or corresponds exactly to the original data. But verification can double the time required by a backup, and you may be tempted to do without it. (*Point-and-Shoot PC-FullBak*, for instance, which scored 3½ minutes on PC Labs' Backup to Preformatted Disks benchmark test, took slightly over 7½ minutes to do the same test with verify on.) We tested these programs for their ability to get it right the first time by detecting and correcting for user error and defective disks.

In one test, we tried to reuse a floppy disk that had been used earlier in the same backup. Almost all of the programs either refused to use the disk from the same backup set or had an option to warn you if you tried to use such a disk. (DOS's BACKUP doesn't have any checking feature and will cheerfully overwrite the same disk if you leave it in the drive.)

In another test, we fed in a damaged disk to see if the programs would notice that something was wrong. The programs differed dramatically in their ability to deal with this problem. Some, *Bakup* among them, skillfully blocked out the defective area of the disk and used the area that was undamaged. Some rejected the disk, asked for another, and successfully resumed the backup. Some, like *Back-It*, recognized that a disk was bad but made us start the whole backup over from the beginning. Some locked up the computer—which at

least served as a warning that something was seriously wrong. The worst performance in this test was by programs that wrote to the disk as if nothing at all were amiss and only reported that a file was unreadable when we tried to restore it.

Somewhere among these 15 programs is the one that combines the safety and convenience features that best fit your needs. If you don't regularly use backup software—or backup hardware like a tape drive or removable hard disks—your data is in constant danger. You need one of these programs now.

## BackEZ

This well-named package stands out as one of the easiest of all backup programs to use. It isn't the fastest or the most powerful, but if you want a straightforward program that gets the job done with a maximum of clarity and a minimum of fuss, EZ-Logic's \$99 *BackEZ* is one to look at seriously. Its logical structure and copious help screens let you throw away the manual. And its informative and well-designed screens are among the few that can hold your interest during the long tedium of a backup session.

Since *BackEZ* reproduces the directory structure of your hard disk on its backup disks, you can use the DOS COPY command to restore any files small enough to fit on a single floppy disk if you manage to lose your copy of *BackEZ* itself. A clear tree diagram lets you choose files to include or exclude from a backup, and one keystroke saves your choices to a configuration file. One minor inconvenience in the tree diagram is that the cursor doesn't automatically move down to the next line whenever you mark a file. Another is that you have to remember the names of your configuration files because the program won't display them on a menu. But one thoughtful touch is that you don't have to work your way back to the top menu to begin a backup when you've made your choices.

It's difficult to make mistakes with *BackEZ*. Unlike the many programs that rush ahead without asking questions as soon as you hit a key, *BackEZ* usually waits until you press Enter after choosing any option. When it finds data on a backup disk, it politely asks whether you want to delete it or whether you want to add the new backups to the data already on the

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CIRCLE 110 ON READER SERVICE CARD



*BackEZ's* informative screen tells you everything about your backups—including any bad news about damaged disks or shaky files. While a backup is being performed, an indicator gradually shows the extent to which the current disk has been filled.

disk. All backup data is stored on floppy disks in subdirectories of a directory whose name includes the number of the backup (in a sequence starting either from the first backup you made with *BackEZ* or from any arbitrary number you choose) and the number of the disk within the back-

up set. This means you can simply use DOS's DIR command to sort out the sequence of your backup disks.

*BackEZ* keeps a log file on the hard disk only. The program doesn't use the log for anything, but you can scan with a file browser or text editor to find the backup

number and disk number that contain any files you need. When you restore a file, you can either have the program search the backup disks until it finds it, or you can insert the disk that you located in the log file. It's a roundabout method but easier than most.

Among the many options on the configuration screen is one that lets you specify a disk-formatting program for *BackEZ* to use instead of its rather slow built-in formatter. Other options let you decide whether the program should prompt you before overwriting files on a restore and whether it should bother to prompt you to insert a floppy disk on the backup. The latter option lets you run the program entirely from a batch file without having to answer prompts if the data you want to back up will fit on the disk to which you direct the backup. And *BackEZ* will back up to any DOS device—anything that uses a letter for its name, including network servers. One thing *BackEZ* won't let you specify is whether or not to back up hidden, system, and read-only files. It backs up and restores everything, except for DOS system files.

The benchmark tests seem to indicate that *BackEZ* doesn't break any speed records, but the raw figures don't reveal that *BackEZ* is the fastest of the programs that reproduce the hard disk's DOS directory structure on the backup disks. This is an important point to consider if you want backups that can be restored with standard DOS commands. But if you want speed, start with formatted disks, because *BackEZ* makes you drum your fingers impatiently while it formats disks for you.

**PC FACT FILE**

**BackEZ, Version 4.0**  
EZ-Logic, 315 S. El Monte, Los Altos, CA 94022; (800) 636-6442, (800) 544-4353 (in Calif.), (415) 949-2834. List Price: \$99. Requires: 384K RAM, hard disk, DOS 2.0 or later.

In Short: *BackEZ* has lucid menus, a logical structure, and reasonable speed. It reproduces the DOS directory structure on the backup disks for easy restores.



**PC COPY PROTECTION**

**FYI**



For the past 6 years, *PC Magazine* has diligently reported whether each application software package we reviewed was copy protected or not. Five years ago, 3 years ago, even 2 years ago, copy-protected software was still widely marketed, causing headaches and frustration wherever it went. Now, however, the overwhelming majority of software packages (including one of the most notorious offenders, *Lotus 1-2-3*) are no longer copy protected. Therefore, we will mention copy protection only when a program has it. If the Fact File's "In Short" section says nothing about copy protection, then the program is free of it.

## Back-It

You may want to cover your eyes when *Back-It's* garish menu explodes across your screen. Everywhere you look there are brightly colored options, with flashing lights and urgent messages popping up all over the place. It's almost enough to make you give up that expensive VGA color for the quieter look of monochrome.

Hyperactive as *Gazelle Systems'* \$129.95 backup package appears, it gets the job done safely and quickly. So while the screen never calms down, you can feel calm because your data is resting safe and sound on its backup disks. And you don't even have to write a label on the disks because *Gazelle* gives you two large sheets of



# Fastback Plus. Backing You Can Trust.

The  
**BEST**  
of  
**1988**

**BACKUP  
SOFTWARE**

**FIFTH GENERATION  
SYSTEMS INC.  
Fastback Plus**

Without warning, your hard disk fails, an electrical storm blitzes your data, or you accidentally delete your entire set of budget worksheets.

One of the fastest, easiest, and least expensive ways to protect against data loss is to invest in Fifth Generation Systems' Fastback Plus. Version 2.01 wins the prize for speed, convenience, and user interface that respects the level of sophistication you demand from a backup program.

Backup and restore can be launched from a command file automatically, if you want to bypass the menus.

**PC  
MAGAZINE**

urely. As for speed, Fastback Plus is ready for the next backup diskette before you finish labeling the one you just removed.

Fastback Plus takes the guesswork out of the backup process by showing subdirectories and their contents on a split screen. Files can be selected for backup by name, date range, directory, or archive bit, or they can be marked individually. A particularly nice feature is Fastback's ability to estimate the

## Fastback Plus

Fastback—a program that backs up your hard disk—is fast, and it is reliable. Now Fifth Generation has improved it. The company fixed the manuals and then put in help files that make the manuals nearly superfluous. Then it added data compression to save disk space and a utility that estimates how many floppy disks and how long the job will take.

With this program, we've copied 38 megabytes of data from one machine to another in 25 minutes (which included formatting the disks). Fast-

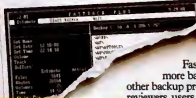
## Fastback Plus 2.01: No More Backup Excuses

### HANDS ON

BY EDWARD MENDLSON

The best backup program is the one that gives you the fewest excuses not to use it. Fifth Generation Systems' \$189 Fastback Plus, Version 2.01, pulls out the rug from under almost every anti-backup excuse you can imagine.

Do your backups take much time? Fastback Plus backs up 10MB of a real-world hard disk to a single drive in 4 minutes.



**PC WORLD**

### EXECUTIVE SUMMARY

#### Fastback Plus 2.0

Hard disk backup utility



Fastback Plus has some of the best backup features and such extras as a keyboard macro recorder and menu-selectable novice and advanced interfaces. The program is fast.

	PC	W	W	W	W
Speed					
Backup selectivity					
Security					
Floppy disk handling					
Overall value					

**Never Trust  
Your Data To  
Anything Less.**

Fastback Plus gets more backing than any other backup program. From reviewers, users and corporate MIS. In fact, it's now the standard by which all other backups are judged.

Fastback's incredible speed, ease of use and proven reliability, make backing up a regular routine. This assures users of having data protection at all times. PC Magazine said it perfectly: There are, "No More Backup Excuses."

Isn't it time you gave your data the protection it deserves? With the best backup the industry has to offer? Fastback Plus.

11200 Industriplex Blvd.  
Baton Rouge, LA 70809  
(800) 873-4384, (504) 291-7221



**Fifth  
Generation  
SYSTEMS, INC.**

## Call for free trial disk

Users of versions prior to Fastback Plus V2.0 can call (504) 291-7681 for upgrade information.

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CIRCLE 286 ON READER SERVICE CARD



## BACKUP SOFTWARE: SUMMARY OF FEATURES



(Products listed in ascending price order)

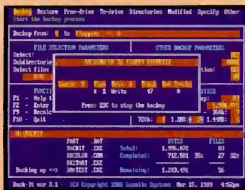
	BackupWiz \$59.00	PC Tools Deluxe \$79.00	BackEZ \$99.00	Backpak \$99.00	COREfast \$99.00	QuikSave \$99.00
<b>FORMAT OF BACKUP DISKS</b>						
DOS format	●	●	●	●	●	○
Proprietary format	○	●	○	○	●	●
<b>TARGET DEVICE SUPPORT</b>						
360K floppy disk drive	●	●	●	●	●	●
720K floppy disk drive	●	●	●	●	●	●
1.2MB floppy disk drive	●	●	●	●	●	●
1.44MB floppy disk drive	●	●	●	●	●	●
Any DOS device with a drive letter	○	●	●	○	●	○
<b>BACKUP TYPES</b>						
Full backup	●	●	●	●	●	●
Backs up files with archive bit set	●	●	●	●	●	●
Backs up by directory	●	●	●	●	●	●
Backs up by wildcard or filename	●	●	●	○	●	●
Backs up files after specified date	●	●	●	○	●	●
Backs up files after specified number of days	○	○	○	○	●	○
Backs up files within date range	○	●	○	○	●	○
<b>RESTORE FEATURES</b>						
Catalog on hard disk lists disk numbers	○	○	●	○	○	●
Program searches full catalog for filename	○	○	○	○	○	●
Allows restoring backups using XCOPY.COM	○	○	●	●	○	○
Can restore to a different directory	○	●	●	○	●	○
Can restore to a different drive	●	●	●	○	●	○
Prompts before overwriting files	●	●	●	●	●	●
<b>SOFTWARE FEATURES</b>						
Runs from batch file	○	○	●	●	●	○
Provides on-line help	○	●	●	○	●	●
Memory-resident scheduler starts backup	○	○	○	○	●	○
Saves user's configuration (backup options and include/exclude lists)	○	●	●	○	●	●
Saves multiple configurations	○	●	●	○	●	●
Saves macro-type command files	○	●	○	○	○	○
Optionally leaves archive bit unchanged	○	●	●	○	●	○
Has "verify backup" option	●	●	●	●	●	●
Estimates number of disks	○	●	●	●	●	○
Uses data compression	○	●	○	○	●	○
Can resume interrupted backup	○	○	○	○	○	○
Formats floppy disks as needed	●	●	●	●	●	●
Recycles "pooled" backup disks	○	○	○	○	○	○
Other major utilities included	None	Disk utilities, desktop utilities, cache, file manager	None	None	File manager	None

Editor's Choice    ●—Yes    ○—No

## SOFTWARE

## BACKUP

Fullback \$129.00	Back-It \$129.95	Point-and-Shoot PC-FullBak \$129.95	TakeTwo Manager \$139.00	Mace Utilities Gold Edition \$149.00	 Intelligent Backup \$149.95	Perfect Backup \$159.95	Bakup \$179.00	 Fastback Plus \$189.00
● ○	● ○	○ ●	○ ●	○ ●	● ○	○ ●	● ○	● ○
● ● ● ○ ○	● ● ● ● ●	● ● ● ● ○	● ● ● ● ●	● ● ● ● ○	● ● ● ● ●	● ● ● ● ●	● ● ● ● ● (except LAN servers)	● ● ● ● ●
● ● ● ● ○	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ○	● ● ● ● ●
○ ○	○ ●	○ ○	● ○	○ ●	○ ●	○ ○	○ ○	○ ●
○	●	●	●	●	●	○	●	●
○	○	○	●	○	●	○	○	●
● ● ○	● ● ●	○ ● ●	○ ○ ●	● ● ●	● ● ●	○ ● ●	○ ● ○	● ● ●
● ○ ○	● ● ○	○ ○ ○	● ● ○	● ○ ○	● ● ○	● ○ ○	● ● ○	● ● ○
●	●	●	●	●	●	○	○	●
○ ○ ●	● ○ ●	● ○ ●	○ ○ ○	● ○ ○	○ ○ ●	○ ○ ○	○ ○ ●	● ○ ○
○ ● ○ ○ ○	● ● ○ ○ ○	● ● ○ ○ ○	● ● ○ ● ●	● ○ ○ ○ ○	● ● ○ ○ ●	● ● ○ ○ ○	● ● ○ ○ ●	● ● ○ ○ ○
None	None	None	File manager, undelete	Disk utilities, cache, undelete	File manager	None	None	None



You can change the default colors on Back-It's blinding screen if these colors are too much for you. It's worth watching the screen, though, because Back-It tells you every detail of its progress and reminds you which keys to press for more information.

numbered labels with the package.

*Back-It* is one of the fastest among the packages tested by PC Labs. Although some others outperform it when starting with unformatted disks, *Back-It* moves in the same league with the best when you feed it disks formatted by DOS or by its own format routines. *Back-It* creates DOS-formatted disks and can be told to format 360K disks for 720K in a 1.2MB drive. Gazette Systems says it finds this option reliable, but you may want to hesitate before pushing any floppy disk beyond its rated capacity.

Although a command-line syntax for *Back-It* is buried deep in the manual, you'll probably want to begin by using its Lotus-style menus. You can specify almost anything: which of three levels of backup verification to use, whether or not to reset the archive bit after a backup, whether to back up modified files or all

files, whether to overwrite data on floppies, whether to use a date range to determine which files to back up. You can save and load a configuration at any time. Some configuration files come with the disk, but the filenames on the disk don't always match the ones reported in the manual.

*Back-It*'s cornucopia of options doesn't include all the choices that you may need. Although you can back up modified files only, you can't explicitly link an incremental backup to the last full backup, and you have to start each new backup on a new disk. And there's no option for a "differential" backup that backs up every file altered since the last full backup.

The program refuses to back up the DOS system files in the boot directory of your hard disk. On the other hand, it will back up any other system files on your disk, and there is no option to prevent this. The manual warns against using *Back-It* with copy-protected programs that expect to find such files at a specific location on the disk and refuse to load if they don't.

When *Back-It* finishes backing up, it leaves a log file on your hard disk but doesn't use the log for anything afterward. You can scan the log with a file viewer to find out which disk has the file you want to restore, or you can use the List function on *Back-It*'s menu to read (slowly) the contents of any backup disk that you think may have the file you want to restore.

The overactive menus make restores of single files or directories a bit cumbersome. When you select the Specify or Directory option after choosing Restore, a pop-up message tells you that these options are available only when you are in the

restore process—and you thought you already were. In fact, you have to choose Restore again, and now you can select files or directories before choosing Restore a third time in order to start the ball rolling.

This confusing structure makes it a bit too easy to start restoring everything from the floppy disk when you want only one file. This mistake can be dangerous if you have *Back-It* set to overwrite files on the target without prompting and you don't want the newer files on the hard disk to be replaced with the older ones on the backup floppy.

If you give *Back-It* a wildcard file specification like *LETTER.\** when you restore, the program prompts you to insert each backup floppy disk in sequence. Then it slowly scans the files on the disks and prompts you whenever it finds a file that matches the specification.

*Back-It* backs up and restores to anything with a drive letter and can use up to four floppy disk drives at the same time. Giant partitions created by DOS 4.0 won't faze it. It handles most errors gracefully, but if it encounters a disk with a bad first track it abandons the whole backup and makes you start over from the beginning. I found that if you open the drive door just a split second too soon when changing floppies, *Back-It* will think the first track is bad and will make you pay for your mistake by repeating the whole backup from the beginning.

## Backpak

*Backpak*, an almost minimalist backup program with few options and a laconic style of menus and messages, is built on a design philosophy that is either just what you always wanted or just what you always dreaded.

The notion behind California Software Products' \$99 package is this: the best set of backup disks is a set that exactly corresponds to the current contents of your hard disk and doesn't waste floppies on older versions of your files. When you choose *Backpak*'s Incremental Backup option, it uses the same disks that you used for the last full backup and overwrites the earlier backed-up copies of your files with copies of any new versions. Consequently, after an incremental backup, you can't use the earlier full backup to restore previous versions of your files.

But *Backpak* goes further than this in its



**FACT FILE**

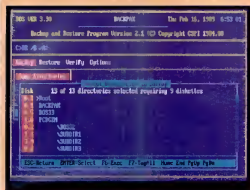


**Back-It, Version 3.1**  
Gazette Systems, 42 N.  
University Ave., #10,  
Provo, UT 84601; (800)  
233-0383, (801) 377-  
1298  
List Price: \$129.95  
Requires: 348K RAM,  
DOS 2.0 or later.

**In Short:** Very fast backups and restores from an over-extended-looking menu. Although *Back-It* is a highly powerful program, it lacks some of the fine-tuning options that you can find in other packages.

CIRCLE 387 ON READER SERVICE CARD

## SOFTWARE BACKUP



Backup's selection screen tells you how much of a floppy disk each directory will require when backing up. One window shows the command-line switches that will produce the same results as the selection being made in the menu.

passion for backups that mirror the hard disk. If you've deleted any files from your hard disk between the time of the full backup and the incremental backup, *Backup* wipes those same files from the backup disks when you perform the incremental backup. And when *Backup* deletes a file, the file doesn't answer back. Although *Backup* reproduces the DOS directory structure of your hard disk on the backup floppy disks, no trace of a deleted file remains on a backup disk, so you can't recover it even with an undelete utility.

If you never delete a file by mistake, and if you never need to recover an earlier version of a file, *Backup*'s philosophy has real advantages. You don't have to work your way through a stack of incremental backups to find the one that has the file you need—it's always part of the main set of backup disks. And even if you do need a

deleted or earlier file from your backups, you may be lucky enough to recover it before an incremental backup makes the earlier version disappear. The whole system would make more sense if you could use it to reproduce the contents of one hard disk on another, but *Backup* only works with floppy disks—and works more slowly than much of its competition.

*Backup*'s minimalist approach is reflected in the limited number of options accessible from its pull-down menus. The backup menu lets you select only the whole disk or a group of directories; moreover, you can't exclude individual files unless you exclude the whole directory. If you want to make a standard list of directories to back up, you'll have to type out all their names in a text editor. The restore menu lets you type in the filenames of individual files but doesn't give you a file list to choose from. The options menu lets you choose whether to include newly created directories in an incremental backup, whether to format all backup disks without prompting, and whether to copy all files or only modified files when restoring to the hard disk.

When you make selections from *Backup*'s menus, you aren't giving instructions directly to the backup program. Instead, the menu program merely feeds command-line parameters to separate programs that perform backups, restores, and optional disk verifications. Once you're familiar with the parameters (which can be displayed on the menu screen), you can skip the menus entirely.

If you use the menus, you'll be annoyed to find that the menu program and the com-

mand-line programs don't communicate very well with each other. The command-line programs keep beeping at you with prompts to insert disks that you had already inserted when prompted by the menu program. The command-line programs also don't communicate very well with you. The screen displays mystifying messages like "Note actual clusters = 2112 (change = 6)." The manual doesn't explain these, and you are apparently not expected to do anything about them. At the end of the backup, you're prompted to reinsert the first disk so that the program can store the files it uses when restoring or incrementing.

One or two minor inconveniences are worth noting. You can't simply break open a box of disks and start backing up. The first disk must always be formatted first—even if you've set the program's options so that it reformats the disk before it starts copying files. The flip side of this is that *Backup* reads that formatted disk in order to determine its size, so you don't have to tell the program which size drives you use.

Finally, although *Backup* will back up hidden files (it skips over system files), it won't restore them. Instead, it warns you rather obscurely of "possible usage for software protection". It's up to you to figure out how to get those hidden files back on your hard disk if you want them.

## Bakup

Second Ring Publishers' \$179 *Bakup* is the backup program for people who like challenges. Almost everything about the program is challenging—menus that don't work the way you expect them to, a dangerous quirk that can convince you that you no longer have any backups when you really do, the requirement that all backup disks be formatted in advance, the challenge to find plenty of free time while the program lumbers through one of the slowest backups this side of DOS's BACKUP, and more.

At least the program gives you ways of overcoming some of these challenges. A supplement in the back of the manual lets you know that if you run out of formatted disks, you can press Esc to slip temporarily into DOS and format a disk whenever *Bakup* is not actually backing up. But you may be more bothered by everything the program doesn't give you.

## PC FACT FILE

**Backup**,  
Version 2.107  
California Software  
Products Inc., 525 N.  
Cabrillo Park Dr., Santa  
Ana, CA 92701; (714)  
973-0440.  
List Price: \$99  
Requires: 256K RAM,  
hard disk, DOS 2.0 or later

**In Short:** Backup's insistence on deleting files from backup disks after you delete them from your hard disk makes this a program to use only in special circumstances. Limited options and slow speed further restrict its appeal.



CIRCLE 398 ON READER SERVICE CARD

We keep telling people  
this is not a laser printer.



The new \$995 HP DeskJet PLUS Printer.

# But they keep looking at the evidence.



Mr. Arnold B. Jones  
220 Bush Street, Suite 945  
San Francisco, CA 94104

Dear Reader:

Imagine being able to print out merged text and graphics that look so realistic, they're almost indistinguishable from the original. You can do this by using the \$995 HP DeskJet PLUS printer. You can also do this by using the \$995 HP DeskJet PLUS printer. You can also do this by using the \$995 HP DeskJet PLUS printer.



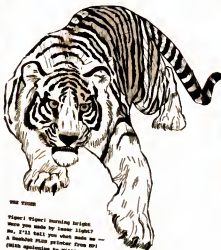
There are a lot of many reasons to choose the HP DeskJet PLUS printer. Delivery for this unit and graphics software by the end of the year.

Sincerely,

*Alan Gruber*  
Alan Gruber

One reason you can't get graphics around on DeskJet PLUS printer is because your computer (or other program) can't handle it. We call it a "print" error.

Of course, you can't get graphics around on DeskJet PLUS printer. We call it a "print" error.



THE TIGER

Tiger! Tiger! burning bright  
None you made by laser light?  
No, it's all yours when made by —  
A Hewlett-Packard printer from HP!  
(With apologies to William Blake)

## MegaCorp 1988 Sales History



You won't believe your eyes (or ears), either. The HP DeskJet PLUS printer gives you the same crisp, black lettering. Clean, sharp graphics. And whisper-quiet operation. But it uses advanced inkjet technology to supply these laser-like qualities for the price of a 24-wire printer.

For just \$995, you get 300 dpi in a trim 15-pound package that's twice as fast as the original. What's more, it has built-in landscape and improved font selection. Including ten built-in fonts and over 100 optional fonts, with sizes up to 30 points. And its 20,000-hour MTBF

assures a long, happy life.

So call 1-800-752-0900, Ext. 276J for the name of your nearest authorized HP dealer. Then judge the HP DeskJet PLUS printer for yourself.



**HEWLETT  
PACKARD**



## BEYOND FLOPPY DISKS: A Look at Backup Alternatives

by Catherine D. Miller

For data you just can't afford to lose, regular backup is a must. And for most users who back up their personal files, backing up to floppy disks is both the fastest and the easiest method, a fact demonstrated by the 15 backup software packages we tested.

If you need to back up larger amounts of data on a regular basis, however, other types of media can be a better solution. The time you spend feeding your computer floppy disks ends up being more significant than the number of megabytes per minute the backup program can transfer to floppy disks—not to mention the burden of managing the large number of floppy disks necessary to store all that data. Media with larger storage capacities don't require constant supervision, so backups can take place when you're not working at your computer.

An alternative to floppy disk backups is any application that requires you to keep an accurate record of all your transactions—not just the end results. If you use floppy disks for backing up these records, you will have to keep track of them all. And even with the sophisticated compression techniques of a backup program, 1.2MB or 1.44MB floppy disks will pile up faster than media with 40MB and 60MB capacities.

### UNATTENDED TAPE BACKUP

Tape is probably the most commonly used of the many forms of unattended backup. While many tape formats

abound that support 150MB and more, the DC2000 minicartridge technology remains the most popular for individual backup.

The DC2000 systems following the Quarter-Inch Compatibility Committee's QIC-40 (40MB capacity) and QIC-80 (80MB) standards run off the floppy disk controller. As a result, they can be used with backup programs that can back up to any DOS device. (Other DC2000 tape systems adhere to the QIC-100 (100MB) standard and require their own controller boards.)

A single 80MB tape can store the same amount of information as 67 1.2MB or 56 1.44MB floppy disks, with transfer rates of up to 2MB per minute. The transfer rate is limited by the speed of the floppy disk controller, so faster disk controllers will give better transfer rates. Archive Corp. offers tape drives in both the QIC-40 and QIC-80 formats; its ArchiveXL Series 40 (\$499) handles 40MB, while the ArchiveXL Series 80 (\$699) handles 80MB.

Each tape drive manufacturer supplies its own backup software designed to work with the tape drive's specific capabilities. Since tape drives can be programmed to perform the backup chore at user-specified times, the likelihood that backup will be performed is increased. No need to stop everything in the middle of the day to back up your system; in fact, you don't have to remember to back up at all. And tape is a

more durable medium than floppy disks.

A unique approach to tape backup is provided by a combination hardware and software system from Digital Storage Systems called PcARC. A buffer card with 224K RAM and a 68000-series processor temporarily stores files as they are accessed, then writes the data to a QIC-02 format (using DC600 tape cartridges) tape drive. The processor on the buffer card prevents degradation of

With tape there is no need to stop everything to back up your system.

your PC's performance while writing to tape.

PcARC's software is RAM resident, occupying only 8K of memory, so the process doesn't require the user to initiate the backup process. And since the program is always recording your work, if disaster should strike you will have a record of all your work within one transaction of the failure. PcARC also features selective and

You can't create or save a list of files or directories to include in a backup. The best you can do is write a batch file that switches into each directory with files you want to back up, then runs *Backup* with something like `"*.* WK1"` as a parameter. You can't exclude specific files from a backup, nor can you exclude subdirectories. You can't exclude hidden or system files, although *Backup* knows enough not to back up the DOS system files in your root directory. *Backup* also won't prompt you before overwriting any files that already exist on your hard disk—although, if you have

enough foresight to ask, it lets you choose between different versions of the same file that you backed up at different times.

Some of the security features in *Backup* can leave you feeling very insecure at the worst possible moment. Imagine for a moment that your hard disk failed and you had to replace it. Fortunately, 10 seconds before it failed, you used *Backup* to make a complete backup of the disk, so you are certain that nothing has been lost. So you set up and format your new hard disk, install *Backup* on it, and start the restore process. You know that you don't start from

the Restore entry on the menu. Instead, you go to the Utilities menu to Recover the backup catalog from the last backup floppy. A warning appears on-screen that this process mustn't be interrupted because a power failure could render *Backup* unusable. After checking the weather forecast to make sure no thunderstorms are expected, you proceed to recover the backup catalog.

Now you try to begin the restore process itself—but *Backup* startles you with a message reporting that you have no files at all to restore. At this point you either panic

## SOFTWARE BACKUP

speedy restoration—18 minutes to read back a 60MB tape—of your files to a hard disk. At \$595 for the buffer card and software (\$995 with a 60MB tape drive and \$2,295 with a 150MB tape drive), Digital Storage Systems' fail-safe method is expensive, but none of your valuable time is spent on backup procedures.

### QUICKER, MORE COSTLY

The speediest and most-expensive backup media are removable hard disks and cartridges like the Plus Passport and Bernoulli. Removable media usually come in 10- to 40MB disks and cartridges; they can be internal or external. Since these are DOS devices, you can use just about any of the backup software packages reviewed here.

If you need to back up very large amounts of data, other tape cassette and cartridge formats requiring their own controller cards and software have much greater capacities. DC600-style cartridges have capacities of up to 250MB and data transfer rates as high as 10MB per minute. DATs (digital audio tapes) have capacities in the 1.2-gigabyte range, and 8mm helical scan units based on video recording technology can handle up to 2.2 gigabytes. Neither, though, is particularly speedy.

WORM (write-once, read-mostly) devices, based on optical technology, provide excellent durability and storage capacity (as high as 2.4 gigabytes). This type of backup is relatively inexpensive and indestructible. ■

Catherine D. Miller is a staff writer at PC Magazine.

or stay sufficiently calm to locate the manual. Here, after some frantic page flipping, you discover that you forgot one crucial detail. *Backup* expects the volume label on the new hard disk to match the volume label that it had previously stored on the backup floppies. If the two labels don't match, *Backup* doesn't give you a warning message or explanation. It simply doesn't do anything at all. If you don't remember the volume label on your old hard disk, you could be in big trouble—unless you studied the manual thoroughly enough to discover that you can press the minus key

	To Be Backed Up	Current Progress
Number of Directories	12	2
Number of Files	175	12
Number of Bytes	91254	1718
	Estimated	Actual
Number of Backsets	9	1
Elapsed Time (minutes)	14.0	.8

CURRENT	ITD00009
Volume	FDISK.COM
Filename	SHOOTIN
Directory	

1374495 18 06:55

*Backup's* sparse-looking screen won't distract you, and its minimal information is more than adequate. The Path window at the bottom lets you use subdirectories seven or eight levels deep—more than you should even consider.

to learn the volume label recorded in the catalog. The menus don't give you any clues.

The menus don't give you much help at all. Pressing Enter next to a directory doesn't mark its files for inclusion in a backup. You have to press F4 (not mentioned on the menu) and then type in the name of the directory you want to include. F6 lets you type in a file specification. Until you study the manual intensively, *Backup* makes it very difficult to remember whether menu choices will have any effect or whether you have to press a half-dozen other keys first.

When *Backup* installs itself on your hard disk, it puts itself into a directory bafflingly named ITDIR. It also puts a second copy of the main program into the root directory. However, when you want to run a full restore, you have to remember to run the program from the root directory, although you can run partial restores from *Backup's* own subdirectory or any other subdirectory.

Another thing to remember when using *Backup* is that it has a "volume pooling" feature that lets it go back and reuse backup disks that are labeled with lower numbers than the last disk you backed up. This system runs into trouble when you need the last backup disk for a restore—and the last one is not the disk with the highest number. To help you keep track, the package includes a card marked "Last Disk" that you can insert in the sleeve of the last disk you used. Just don't let the card drop out of a stack of 50 floppies.

Despite all of these complications, *Backup* does have some redeeming features

that may make the package worth your notice. Because the program reproduces the DOS directory structure on your floppies, you can append incremental backups or partial backups to existing backup floppy disks.

*Backup* can also locate the files for a selective restore from the catalog on the hard disk without making you feed a dozen floppies into the drive. It handles errors so gracefully that it was unfazed by a disk with a hole punched in it. The program simply reported which files failed to get backed up and asked if you wanted to retry each in turn. Finally, *Backup* has the good sense not to waste space by backing up its own 320K of program files and overlays to your floppy disks.



In Short: An arcane command structure and slow performance make *Backup* a frustrating program to use. It does offer excellent error correction.

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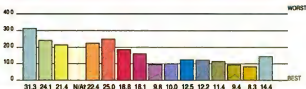
PC Labs tested the current crop of backup software under conditions your own system might face, using 1.2MB floppy disks to back up 172 files (9.7MB worth). *Fastback Plus*, one of two programs to receive an Editor's Choice,

was more than twice as fast on preformatted disks as the average program: It finished the test in 3.6 minutes, indicating a throughput rate of 2.7MB per minute. *Intelligent Backup*, the other Editor's Choice, won that designation for its features, not its speed.

## Unformatted Backup

Elapsed Time (minutes)

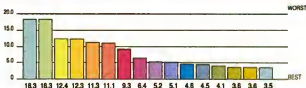
The Unformatted Backup test measures the time it takes to back up 172 test files (totaling 9.7MB) to unformatted 1.2MB floppy disks. The program must first format each floppy disk before transferring files. For best performance times, verification is turned off and the lowest level of data compression is selected.



## Preformatted Backup

Elapsed Time (minutes)

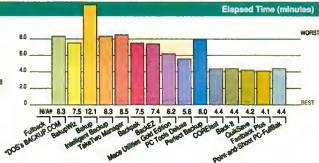
The Preformatted Backup test measures the time it takes to back up the test files to 1.2MB floppy disks previously formatted by the backup software being tested. This test most closely simulates ordinary backup procedures. For best performance times, verification is turned off and the lowest level of data compression is selected.



## Restore to Hard Disk

Elapsed Time (minutes)

The Restore to Hard Disk test measures the time it takes to restore to their original 32MB hard disk all files backed up in the Preformatted Backup test. As if a total system crash had occurred, the hard disk is freshly low-level and DOS formatted beforehand. All restore options are set for the fastest possible operation.



N/A † —Not applicable: Backup requires formatted disks to perform backups.

N/A ‡ —Not applicable: Fastback does not offer a restore program.

DOS's BACKUP.COM program was not reviewed, but we are reporting its test results for comparison.



## PERFORMANCE TESTS: BACKUP SOFTWARE

## Testing Backup Software

To test the backup programs, we used an 8-MHz IBM PC AT running DOS 3.3 with a 32MB hard disk, a 1.2MB floppy disk drive, and 640K of conventional memory. Unless otherwise directed by the software vendor, we set BUFFERS to 3. The test data was created by a file generator called PCGEN, developed internally at PC Labs. The test files consisted of 11 primary subordinate directories, each with 3 levels of its own subordinate directories. There were 162 files, totaling 9.167MB, and an additional 573K in ten files marked with the "hidden" system attribute. Files so marked can pose problems for some backup software.

For both backup and restore, hard disks

were first low-level formatted and then DOS formatted (in both cases using IBM Advanced Diagnostics and DOS 3.3, respectively). The time needed to extract a disk and put it back in the floppy disk drive manually was counted in the performance times. To minimize the effect of handling the disks, the procedures were done twice and the lower of the two times reported.

Backups were done to a 1.2MB floppy disk drive with verification (error checking) turned off to minimize performance times, though this method is not recommended for actual backup procedures. Using verification or error checking could typically double the given backup times. When data

compression was available, the lowest level of compression, as specified by the vendor, was selected.

Files were restored to the same hard disk from which they were backed up after the disk was freshly low-level and DOS formatted. While no attempt was made to test file restoration to an active hard disk structure, the resulting times would prove slightly longer as the software checked file allocation tables and stepped over fragmented areas. All restore options were set for the fastest possible operation (as designated by the software vendor).



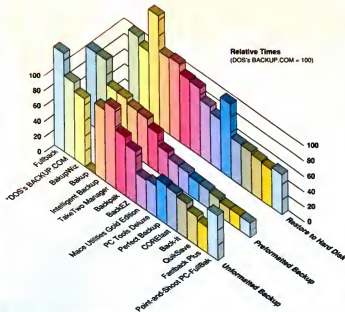
## BACKUP SOFTWARE PERFORMANCE TESTS: COMPOSITE VIEW

The first of the two backup procedures tested by PC Labs used floppy disks fresh from the box and required the backup program to format them before (or during) the backup. ALPS' FullBack was the worst of the group, taking slightly longer than a half hour—a throughput rate of roughly 317K per minute—and taking nearly 30 percent longer than DOS's BACKUP on unformatted disks (using the /F backup option). In a real-world situation, however, even FullBack would finish ahead of Backup, which requires formatted disks but can do neither its own nor DOS's formatting.

For the second procedure—using the preformatted disks created during the first Intel—times improved dramatically. Only QuikSave, Fastback Plus, and Point-and-Shoot PC-FullBak, however, achieved throughput rates greater than 2.8MB per minute, completing the task in less than 3.7 minutes.

When restoring data, DOS's RESTORE program achieved times that challenged half the tested software. Seven programs—Mace Utilities Gold Edition, PC Tools Deluxe, COREtest, Back-It!, QuikSave, Fastback Plus, and Point-and-Shoot PC-FullBak restored the data in significantly faster times.

In addition to our standard performance tests, other means were used to determine how well each program handled everyday disaster situations. One test attempted a backup to a disk that had been used earlier in the same backup. In another test, we fed the program a damaged disk to see if the program would notice that something was wrong. The results of these informal tests will be found in our reviews.



\* DOS's BACKUP.COM program was not reviewed, but we are reporting its test results for comparison.

## BakupWiz

**BackupWiz** is an inexpensive, uncomplicated backup program with simple menus and a unique security feature. If the privacy of your data matters to you, PCX's \$59 program may turn out to be the best choice despite its lack of many features and conveniences taken for granted in most other programs.

Running *BackupWiz* is a simple matter of typing BW at the DOS command line. A Lotus-style menu immediately offers you four options: backing up, restoring, reading the directory of a backup, or formatting a floppy disk.

Under the backup option, you can choose all files, modified files, selected files, selected modified files, or files created or modified after a specified date and time. If you want to limit the backup to selected files instead of the full disk, you type the file specifications into a menu. You have to memorize the names of the files you need because *BackupWiz* won't show you a directory from which to select them. You can only include files and sub-directories; you can't exclude specific files or any subdirectories from the chosen directories. If you choose a date-restricted backup, you have to enter the date using the exact format "03/21/89 12:31"; anything else produces an error message.

When you've chosen the backup type and entered the letter of the drive to back up, the program scans the disk and reports the number of bytes in the chosen files. It doesn't estimate the number of bytes required, but you can make an educated guess. Next it prompts you to give an optional name for the backup, then an option-

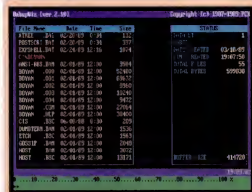
**FACT FILE**

**BackupWiz,**  
Version 2.10  
PCX, 13734 Boquita  
Dr., Del Mar, CA 92014;  
(619) 259-9797.  
List Price: \$59  
Requires: 512K RAM,  
hard disk, DOS 2.0 or  
later.

**In Short:** BackupWiz has a password-protection scheme that can protect backups from casual snoopers. Its menus are easy to use but offer only slow operations and a severely limited range of options.

CIRCLE 400 ON READER SERVICE CARD

## SOFTWARE BACKUP



With BackupWiz you get an estimate of the number of floppy disks needed and a constant reminder of the time—not the best news to receive during the slow backup process. The indicator at the bottom is a graphic representation of the progress as a whole.

al password. Finally, and slowly, the program starts backing up to your floppy disks—although it will prompt you for confirmation if you insert a disk that has already been used for a backup. You get this prompt only with the first disk, however. Afterward, the program takes any disk you give it and formats it if necessary.

The password is the point where *BackupWiz* distinguishes itself from its rivals. If you enter a password, no one will be able to restore the files without entering the same password. The manual warns that "If you lose your password, your data is lost—for good." But, for better or worse, that's only partly true. Although *BackupWiz* stores its data in a single file on the floppy and doesn't reproduce the DOS directory structure, the data itself is not compressed or encrypted. So if your data consists mostly of text, anyone can read the complete contents with a file viewer like *PC Magazine's* BROWSE or DR utility.

When you restore an individual file, the program reads the directory from the first disk but can't tell you which disk contains the file you need, so you have to let it grope in its slow, deliberate way through every floppy disk until it finds the file you want. It doesn't make much sense to use *Bakup-Wiz* for anything other than archival backups of your entire disk, with a view toward using the full backup set in case of dire emergency.

*BackupWiz* makes a good start in dealing with error conditions but doesn't follow through. When I used a damaged disk for a backup, the program used as much of the disk as it could, then prompted for a second disk. When I then inserted a good

disk, the program quit with a curious message about an "Unrecoverable tape error"—curious, because the program doesn't support tape drives. Another oddity was the total lockup I invariably encountered when backing up only a single file from the root directory.

When backing up or formatting, the program assumes that a PC or XT use 360K disks, that ATs and compatibles use

If you enter a password, no one will be able to restore the files without entering the same password.

1.2MB disks, that a PS/2 Model 30 uses 720K disks, and that any other PS/2 uses 1.44MB disks. If you have a customized setup or if you need to use smaller disks that your machine can normally handle, you can override the program's assumption with a command-line switch. If you have an EGA, *BackupWiz* displays its menus in 43-line mode. If you have a VGA, it does the same thing, which means that the menu leaves a blank region at the foot of the screen where the VGA expects to find another 7 lines.

If you're interested in trying out *Backup-Wiz*, you can download it from informa-



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CIRCLE 219 ON READER SERVICE CARD

Ever since Version 2.0, every copy of DOS has included BACKUP and RESTORE. They don't have the speed or features of the commercial programs, and they certainly don't look pretty on-screen, but they work.

Or at least they work now. The BACKUP that came with DOS 3.0 was notorious for slowly working its way across a floppy disk and leaving behind an empty file with no data in it. Of course, it gave you no warning that it had done this, and you discovered it only when you tried to restore your most precious file from the backup disk.

Some versions of RESTORE had trouble restoring backups created by a different, earlier version of BACKUP. That meant you were out of luck if you got a new version of DOS, reformatted your hard disk, and tried to use RESTORE to bring back your files.

Microsoft's and IBM's versions of DOS often have subtle differences that make it impossible to use one version's RESTORE on backups created with another version's BACKUP. If you used Microsoft's /P switch to pack as many files into a floppy disk as possible during a backup, IBM's RESTORE couldn't restore your files. Before Version 3.3, RESTORE transferred the system files from backup disks to hard disk, often causing havoc.

Before DOS 3.3, BACKUP created one file on the backup disks to match each file on the hard disk. In DOS 3.3 and later, DOS copies the trick used by many commercial programs of packing

## Doing It with DOS's Own BACKUP and XCOPY

by Edward Mendelson

**RESTORE allows you to transfer only files that aren't on the target disk.**

files from the hard disk into a single file on the floppy disk. This change doubles BACKUP's glacial speed, but it means that backups made with DOS 3.3 and later can't be restored to computers running earlier versions.

Since IBM's Version 3.3 (earlier in Microsoft's versions), RESTORE has had sophisticated switches that let you restore only modified files or files created after a certain date. You can also tell RESTORE to transfer only files that aren't on the target disk—a feature you won't find in many commercial programs.

The BACKUP in Version 2.x could back up only to floppy disks, but Versions 3.x and 4.x can back up to another hard disk or other DOS device, as well.

DOS 3.2 introduced the XCOPY

command, which can serve as a reasonably fast and totally reliable backup program if none of your files is larger than the capacity of your floppy disks. Use the command with this syntax:

```
xcopy c:\ a:\ /s/m
```

The /S switch makes XCOPY copy all files from the subdirectories below the root directory in addition to all files in the root. The /M (for *modified*) switch makes it copy all files that have the archive bit set and then turn off the archive bit. When the first floppy disk is filled, XCOPY will exit with an error message. You then simply insert another floppy disk, press F3 to bring the previous command back to the command line, and press Enter to run it again. This time XCOPY will skip over the files it copied earlier—because the archive flag on those files will be down—and will resume where it left off. Repeat this procedure until your entire hard disk is backed up.

If you want to make certain that the archive flag is up for all your files before using XCOPY, you can go to the root directory and use this command in DOS 3.3 or later:

```
attrib +a *.* * /s
```

Although ATTRIB dates back to DOS 3.0, only Version 3.2 lets you use it to set the archive bit, and only Version 3.3 adds the /S switch that makes it work in all subdirectories of whatever directory it starts in. ■

tion services like PC MagNet or CompuServe or from any good BBS. If you decide to keep using it, send the author the registration fee. If you don't, you've lost nothing but some time on the phone.

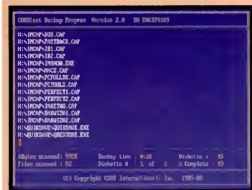
## COREfast

Most backup packages consist of a flimsy paperback manual and a disk. COREfast comes in a sturdy, cloth-covered slipcase and ring binder that make the whole thing look a lot like the DOS manual. Sometimes you can tell a program by its cover,

and CORE International's \$99 backup package is in every way the serious, heavyweight program that it appears to be. It does almost everything, and with impressive speed. The clumsiest thing about COREfast is that overweight manual, which is so badly organized and indexed that you're better off ignoring it and using the extensive help screens instead.

COREfast lets you back up and restore to any disk or DOS device that you can identify with a drive letter, including a network server. It has a built-in file manager that lets you view, copy, or rename files before deciding whether to list them automatically in a catalog of files to include in a

backup—and you can create catalogs and configuration files from many convenient points in the menus. COREfast includes an optional 4K memory-resident scheduler that can run backups or restores at any specified time; it also can run programs or issue any DOS or network command before or after the backup or restore itself. COREfast normally uses a proprietary high-speed disk format unreadable by DOS, but you can choose to create backup disks that use DOS formatting instead—and you'll have to use DOS formatting if you back up to anything other than a floppy disk. COREfast even lets you make image backups, although you should



COREfast's selection menus tend to look complicated, but its progress report, shown here, is clean and efficient. You're told how much of the floppy disk has been filled, so you can be ready to insert another, and how much more of the whole backup process remains.

you or the program which disk contains which file. You have to feed backup floppy disks into the drive one by one until the file you need finally turns up. If your backup consists of 20 or more floppy disks, this can mean a long wait.

## Fastback Plus

When I talked to the programmers who wrote many of the backup programs included in this article, almost all of them had something to say about *Fastback Plus*. It was usually envious.

Fifth Generation Systems' \$189 speed demon is the most efficient and elaborate system you can find for preserving and restoring data. It has a lot more than speed to recommend it, even though its quickness would be enough to make it stand out from its rivals: in two tests it was the fastest program of all, while in another it lagged behind by an interval too small to matter.

As a total backup system, *Fastback Plus* has advantages few other programs approach. No backup task is too complicated for this application to automate. If you need to back up one set of files to a floppy disk, the same set to a network server, and a second set to a cartridge disk, *Fastback Plus* lets you automate the whole process by recording all the keystrokes in a macro. If you want to automate complex backup procedures for your coworkers, you can even include pop-up instructions and prompts in a macro and run the whole procedure from their AUTOEXEC.BAT.

The installation program uses macros to spectacular effect. After copying files to

normally avoid doing anything of the kind.

Like most high-tech backup programs, *COREfast* offers two levels of data compression and three levels of verification. By default it backs up all files, including the DOS system files, but you can tell it to ignore any combination of hidden, system, read-only, or Novell-shareable files. And like any self-respecting advanced backup program, *COREfast* lets you set a date range for files to back up and lets you decide whether or not the program should reset the archive bit after backing up files.

If you're a backup beginner, *COREfast* starts you off with simple menus that give access to simple backup-and-restore functions suitable for unsophisticated users. But when you feel more confident, you should switch to an advanced menu level with a few keystrokes. Only the advanced level gives you access to crucial switches, like the ones that control whether hidden or

system files will be backed up. When you feel really expert, you can dispense with the menus altogether and use command-line switches to control the separate programs that are normally concealed behind the menus.

*COREfast*'s performance in the PC Labs timing benchmark tests places it just below the top rank of backup programs—an impressive performance for an application so rich in features. Yet for all its power and range, *COREfast* suffers from some major and minor inconveniences. A minor one is the way the menus require you to jump around the function keys (or the number keys on the top line of the keyboard) to get anywhere. The list of function keys is arbitrary (although F1 always brings up help), and the arrangement of function keys on submenus bears no relation to the arrangements on the menus above them. If *COREfast* allowed you to type the initial letters of menu choices, or even move a scroll bar, you could use it more easily and accurately.

*COREfast*'s error correction isn't perfect, either. It overwrites disks from earlier backups without any special warning beyond its standard statement that all data will be overwritten on the disk. If you open the drive door at the wrong time, you have to start the backup over from the beginning. And when *COREfast* tried to format a scratched floppy, it just kept trying and trying until I gave up and rebooted.

*COREfast* also gets seriously inconvenient when you want to restore one or two files. The log file on the hard disk and the catalog on the first backup disk lists all backed-up files—but neither one can tell

## PC FACT FILE EDITOR'S CHOICE



### FACT FILE

**COREfast, Version 2.0**  
CORE International,  
7171 N. Federal Hwy.,  
Boca Raton, FL 33487;  
(407) 997-6055.  
List Price: \$99

Requires: 256K RAM,  
DOS 2.0 or later.

In Short: *COREfast*'s multitude of options makes it especially suitable for network environments. But the menu interface is more awkward than it needs to be, error correction is weak, and single-file restores are glacially slow.



CIRCLE 401 ON READER SERVICE CARD

**Fastback Plus, Version 2.01**  
Fifth Generation  
Systems Inc., 11200  
Industriplex Blvd.,  
Baton Rouge, LA 70806;  
(800) 873-4364, (504)  
291-7221.  
List Price: \$189

Requires: 330K RAM,  
DOS 3.1 or later.

In Short: *Fastback Plus* has virtually everything a backup program needs: top-speed performance, clear menus, every imaginable option, even a built-in macro program for automating complex tasks. A superb achievement.



CIRCLE 402 ON READER SERVICE CARD

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and features."*—Lamont  
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ways to view  
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*"We have rated SuperProject  
as the number one package  
in the under \$1,500 cost  
category"*—Daniel  
Yahdavi, iSoft Decision,  
Inc., October, 1988.

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and capacity  
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Woody Liswood,  
November, 1988.  
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CIRCLE 272 ON READER SERVICE CARD

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## DISCARD IT.

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## OR HARDCARD IT.

them onto the new drive. Or waste anyone's valuable working time.

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## SOFTWARE BACKUP

02-08 FASTBACK PLUS 7-25-88

Estimate: 10:15-10:45 Unit: 1

PERFORMING BACKUP Backup C to B: 1.2MB 5.25"

Act Date: 09/02/88  
Act Date: 02-15-88  
Act Time: 12:12:04  
Volume: 1  
Track: 5  
Sector: \*\*\*\*\*

Files:	Estimate	Actual
Files:	120	20
Directories:	560	36
Volumes:	9	1
Time:	5:04	0:25
Bytes/Min:	1895	1394

% Complete: 9

Starting backup of C: on volume 1...

~\$0570C01.CP1

Pressing up/down key will scroll.

*Fastback Plus* takes time to estimate a backup only if you ask it to, but you won't regret spending the time. The estimate column in this well-designed screen gives you an idea of how many floppy disks you'll need and the estimated time required for the backup.

your hard disk and testing your hardware, it runs a macro that tests the program itself by performing a quick backup-and-restore of its own directory. The manual backup you perform later won't be as effortless as this automatic one, but it will come close. Your basic choices include full backups, incremental backups of modified files, and differential backups of all files modified

gets more laconic. The most-advanced users can adjust options ranging from the degree of data compression, write verification, and error correction to use in backups to the sound the program makes when prompting you to insert a disk.

When you begin backing up, you can either get an estimate of time and disk requirements or proceed directly to the backup. *Fastback Plus* alphabetizes your directories and files before writing them to your backup disks, so your data will be in perfect order if you restore to a newly formatted hard disk. By default, *Fastback Plus* rushes ahead and uses any disk it finds in the drive, but you can set it to warn you before it uses either a disk from an earlier backup or any disk that already may have data on it.

Your backup data is stored on floppy disks that DOS can read, although the data is stuffed into large files that can be restored only with *Fastback Plus*. Restores are straightforward and efficient. You can select files by typing in their names or by tagging them on a directory screen. Then you choose Estimate on the Restore menu, and the program quickly scrolls through the backup log on the hard disk and tells you exactly which disks have the selected files. The time-saving trick of using the Estimate screen is so deeply hidden in the manual that many loyal users don't seem to know it's there.

The user interface in *Fastback Plus* presents a simple and consistent structure of moving-bar menus with pull-down submenus below each option. You maneuver either with a mouse or with arrow keys or by hitting the first letter of the item you

want. Keyboard users will find some of the rarely used menus mildly annoying because you have to press Enter to reach suboptions and then press Esc to leave. But a mouse scurries effortlessly through the whole maze.

If you or your colleagues find this system too complicated, or if you're nostalgic for the original *Fastback*, you can find an "alternate user interface" program on the installation disk. With this program, you don't have to move around any menus at all. You are asked about each of the basic details of the backup you want to perform, and the default answer will usually be the right one. The program then passes your answers to the backup program itself, which performs the backup as if you had chosen it from its own menus.

Fast and flexible as it is, *Fastback Plus* somehow finds time to trap errors that trip up many other programs. When I deliberately damaged a disk that *Fastback Plus* had already used successfully and made certain that all write verification was switched off, it still refused to be fooled and calmly asked me to insert a better disk. That kind of calm soon rubs off on anyone whose data is backed up by *Fastback Plus*.

**As a total backup system, efficient and elaborate *Fastback Plus* has advantages few other programs approach.**

since the last full backup. You can append later backups to full backup sets, but you have to start each backup on a new disk—a detail that unfortunately leaves valuable space unused on the last disk of the previous backup.

*Fastback Plus* is a system in which you can customize everything, even the range of options offered by its menus. When you first run the program, it presents limited choices and extensive help screens designed for beginners. Later, you can ascend through two more-advanced levels in which the options increase and the help

## Fullback

ALPS's *Fullback* takes you back while it backs you up. This \$129 package recalls the early days of DOS, when menus were rare, conveniences few, and frustrations many. With *Fullback*, you can back up a hard disk the old-fashioned way, and you probably won't enjoy it. But you may find some interest in seeing how a simple job like backing up a hard disk can be made more complicated than anything you ever imagined.

*Fullback* consists of eight separate programs—some for different kinds of backup, some for preparing disks for use by the backup programs, some for supervising the backup process.

If you simply want to back up your full hard disk, don't use the program that has the same name as the whole package—the program called *Fullback*. For a full backup, you'll want *Halfback*—although *Halfback* won't back up your full disk if any of your files are larger than a single floppy disk will hold. In that situation, you'll have to write down the names of the large files and use a third program called *Bigback* to back up each file individually.



## SITBACK: A Backup Program for the Terminally Lazy

by Edward Mendelson

Sometimes it's just too much trouble to fire up a backup program and copy all those files that have been accumulating on your disk since last summer. Of course, you can get a program that installs itself in your AUTOEXEC.BAT and backs up your files first thing every day, but you can always tell the program you're too busy and put it off till tomorrow.

*SitBack*, a \$99 utility from SitBack Technologies, has the answer. All you have to do is put the letters SB in your AUTOEXEC.BAT, and *SitBack* will load itself into memory, where it occupies 14K. There it lurks, doing nothing until it detects that you have stopped using the keyboard for at least 2 minutes (or any other chosen interval) or until certain times of day that you specify. Then it wakes up and scans your disk for new or modified files. If it finds any, it copies them to any DOS device you specify—a floppy disk, another hard disk, or a network server. You can back up to anything writable that is identified with a drive letter.

Anyone who uses computers can think of objections to this scheme, but the program anticipates almost all of them. It can be told to write only to disks to which you have given the volume label SB, in order not to put files on other disks that may be in the drive.

It doesn't try to pop up a window to offer error messages but gives audible signals in the event that a disk is either full or missing the required label. You can press hotkeys to tell it to pause and then to resume or to cancel a backup entirely. You may use the pause key often, because *SitBack* tends to hog your computer when backing up files, and any application you happen to be working in at the time will become highly sluggish.

If *SitBack* encounters a file that's too big to fit on a single floppy disk, it beeps quietly at you and records the problem in an error log. A separate command-line program lets you view the error log and set various defaults for backup timings, for the sources and targets of the backups, and even for the tones of the beeps. The program is configured to ignore all program files, and you can exclude or include any other set of files.

*SitBack* can perform a total backup, but because it was never designed for speed you may be better off with a different utility for total backups—one that can also back up files larger than a single floppy disk.

A fully functional version of *SitBack* comes with Departmental Technologies' *Take Charge!*, a \$139.95 memory-resident combination of desktop organizer, disk utilities, and Swiss Army



### FACT FILE

#### SitBack

SitBack

Technologies, 7219  
W. 95th St., #301,  
Overland Park, KS  
66212; (913) 894-  
0608

List Price: \$99

Requires: 14K free  
RAM, DOS 3.0 or later.

In Short: A TSR backup utility that keeps watch for new or altered files and copies them to a disk or server. It's slow but reliable.

### SitBack

RELAX

Now You Can Sleep to Your Heart's Content

Continuously  
on by default

CIRCLE 416 ON READER SERVICE CARD

**Take Charge!**  
Departmental  
Technologies Inc.,  
P.O. Box 645,  
Andover, NJ 07821;  
(201) 786-6878.  
List Price: \$139.95  
(includes *SitBack*).  
Requires: 320K  
RAM, DOS 2.0 or  
later (DOS 3.0 with *SitBack*).

In Short: A package containing every imaginable file and disk utility. It's not elegant but always effective.

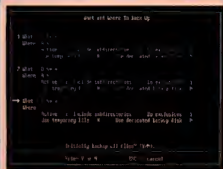


CIRCLE 417 ON READER SERVICE CARD

knife. *Take Charge!* adds a lot of functions for a small additional price but requires about 20K more RAM.

The version of *SitBack* that comes with *Take Charge!* looks identical, and you can even install it without installing *Take Charge!*. But you can't actually use it for backups unless *Take Charge!* is also in memory.

One alternative to *SitBack* is *CORE-fast's* memory-resident scheduler. This can start a backup at any specified time, but only if your computer is idling at the DOS prompt. This is fine if you schedule unattended backups to a tape drive or server when you're not in the office. But if the scheduler calls for a backup while you're working on something else, it plays a little tune to remind you that it's time to backup. And you're free to ignore it.

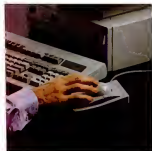


Normally, *SitBack* is heard but not seen; you see it only when you read the error log or set default options. The screen at left lets you list the drives and files that you want the program to backup.

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CIRCLE 750 ON READER SERVICE CARD

Fullback does its work extremely slowly and adds insult to injury by not giving you anything to look at except a list of files. Notice the message warning you about a file too big to back up. You'll have to use another program in the package to back that one up.

To give the *Fullback* package the best possible chance at scoring well in timing tests, we used DOS's XCOPY to restore all of the files and directories on the backup disks. (The *Fullback* manual doesn't mention XCOPY anywhere.) We ran XCOPY once for each backup floppy disk, then ran BigBack a few times to restore the files that were too large for the floppies. All in all, it wasn't an experience I'd want to repeat.

## Intelligent Backup

With most backup programs, this is only a misty dream about the way comput-



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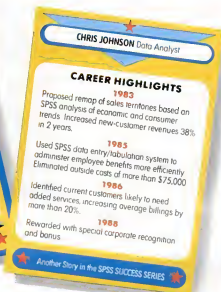
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March 14, 1989



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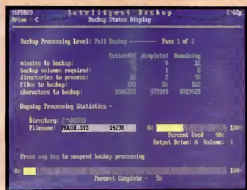
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## SOFTWARE BACKUP



*Intelligent Backup* takes two passes to make a full backup because it keeps older files on different disks from newer ones. The display is clear and informative; it lets you know when to be ready with a new disk and how far along you are in the complete process.

ers ought to work but never do. With *Intelligent Backup*, it's normal procedure.

Sterling Software's \$149.95 backup package does almost everything more intelligently than anyone else's. Its features are so plentiful and yet so unobtrusive that the program almost deserves to be called luxurious. If it isn't the ultimate backup program—yet—that's because it lags behind almost all of the competition in speed.

*Intelligent Backup* takes almost three times as long as the fastest programs to back up a full disk, and it doesn't offer the compensating advantage that backup files can be restored simply using the DOS COPY command. (Its backup disks use DOS formats, but all the files are stuffed into one monster file on each disk.) On the other hand, this program is so intelligently designed, and thus aptly named, that you may not bother with a full backup more than two or three times a year.

*Intelligent Backup* does a lot of planning behind the scenes so that you don't have to. When you make a full backup, the program quietly arranges your files on separate disks according to whether or not the files are less than a certain number of days old. (The default is 45 days, but you can change it.) You won't have to touch the disks with the older files unless you need to restore your full hard disk.

The next time you run the program, it scans your hard disk and backs up any altered files. These incremental backups are appended to the files on the newer disks, until you approach the last of your "pool" of backup disks. The pool consists of a specified number of floppy disks (you can change the default figure) that you want to reserve for backup purposes—the package includes numbered labels for them and has a built-in utility for printing more.

When the pool is almost full, the program suggests running a Consolidate backup that replaces the accumulated incremental disks with two sets of disks—additional "older" files on disks that you won't touch again and an updatable set of "new" files to which you can append any incremental backup. For complete safety, you can tell the program to maintain two or more sets of backups before recycling disks. And, of course, you can override the program's choice of backup type at any time.

The advantage of this procedure is that you don't have to back up your whole disk every few weeks just to get a current set of backups. *Intelligent Backup* even keeps track of the files you've deleted from your hard disk, so that if you ever have to re-

store the whole disk, it will prompt you before restoring a file that you've already deleted. If you really want the file, it's yours, but if you don't want it, you don't have to waste space on it. A copy of the latest index of backups is on the hard disk and on the most recently used floppy disk, so full restores are as effortless as restores of individual files.

Aside from speed, the sole problem I had with *Intelligent Backup* was its performance on the defective-disk test. The program kept trying to write to the disk until it finally locked up the computer.

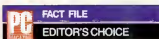
The program also treats directory entries in a way that could, as a very remote possibility, cause a problem in the future. In addition to setting the archive bit, it also changes some bits in the directory timestamp that DOS doesn't use at all. (The program won't change those bits if you tell it not to reset the archive bit after backing up.) It's exceedingly unlikely that any future DOS version will ever use those bits, but if that happens, Sterling Software will need to provide a utility to restore them, and the program itself will need to alter its methods.

With all these options, it's almost superfluous to add that *Intelligent Backup* provides three levels of data compression, two verify options, a file manager that doubles as a menu screen for marking files to be included and excluded, even a built-in word processor for editing configuration files. It can back up and restore to anything that uses a drive letter and has enough help screens to keep you reading for hours, even though you probably will never need them.

## Mace Utilities Gold Edition

The backup-and-restore programs in *Mace Utilities Gold Edition* are licensed from a company called Phoenix Research, but they are perfectly suited for a Mace package. Paul Mace Software's \$149 disaster-prevention kit of hard disk utilities contains a dozen programs with a strong reputation for sturdy reliability combined with an interface that is more utilitarian than elegant. The backup-and-restore programs deserve a similar reputation.

Instead of combining backup, verify, and restore functions in one program, *Mace Gold* includes three separate pro-



**Intelligent Backup,**  
 Version 3.1A  
 Sterling Software, 202  
 E. Airport Dr., #280, San  
 Bernardino, CA 92408;  
 (714) 889-0226.  
 List Price: \$149.95  
 Requires: 320K RAM,  
 hard disk, DOS 2.0 or  
 later.

**In Short:** A luxurious, logical, and effortless backup package, with the easiest restores of any program on the market. The only weakness is its surprisingly slow speed.

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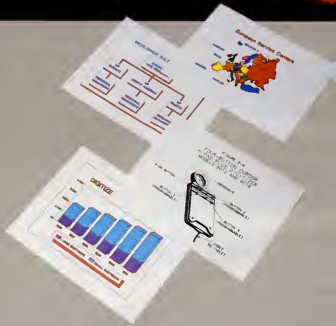
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# SOFTWARE BACKUP



## Mace Utilities Gold

Edition's backup screen doesn't estimate the time it takes to complete a backup, but the small circle moving along the pink line near the bottom gives a general estimate of progress. The timer tells you how much time is wasted inserting and removing disks.

grams for each purpose. The menu-driven interfaces for all three are virtually identical. You move the cursor or press a letter to relocate a moving-bar menu at the top of the screen. Each item on the menu has a pull-down submenu that you can maneuver only with the cursor keys. The Enter key takes you to further submenus, and Esc takes you back out. The logic is inconsistent, and the whole fussy procedure takes more keystrokes than necessary.

Once you have decided on the program options and listed files you want to include or exclude, you can save a "parameter" file that can be shared by all three programs. If you want to skip the menus, you can run the programs from the DOS command line, using as a parameter—you guessed it—the name of one of the parameter files.

Some of the options in these parameter

files are more extensive than those provided by other programs. For example, you can decide whether to save a backup log to the hard disk only, or to the hard disk and the backup floppy disks, or you cannot save it at all. If you don't save it, you'll have to insert each floppy disk in turn to find individual files to restore. If you decide later that this is more trouble than it's worth, the verify program can reconstruct a log file from floppy disks already used for a backup.

*Mace Gold* doesn't let you mark files for inclusion or exclusion on a directory screen. You have to enter them by hand, and the program is strict about making you type in \*.\* if you want to include all the files in the directory. A more tolerant program would let you press Enter instead. Other choices on the menus include whether or not to use error correction, which slows down the backup and increases its size, and whether to verify each backup when it is performed—which doubles the time required for a backup. As *Mace Gold* is one of the moderately fast backup packages, you may want to spare some time for verification. With verification off, the program wrote files to a disk with a hole punched in it as if there were nothing wrong.

The program is better at detecting when you open a drive door at the wrong time. An impatient message states, "Please, do not open the drive door while the disk is in use," and the program resumes when you sheepishly obey. The backup program won't overwrite disks created earlier in the same backup, but it rushes ahead and overwrites any disks from previous back-

ups without asking. You can tell the program not to warn you when you've inserted a DOS-formatted disk in the drive for a backup, but only if you're willing to live dangerously.

*Mace Gold's* backup disks use a proprietary format unreadable by DOS, so you'll need to use the log file on the hard disk if you want to restore individual files without feeding each disk in turn until the file you need turns up. Any file viewer can display the log, but *Mace Gold* suggests that you use the DOS FINDER command in a form similar to this:

```
FIND "WHATDISK.DOC" 890329# .SUM
```

Other backup programs let you scan their log files from a menu, or at least don't make you type in filenames that consist mostly of numbers. The lack of a similar feature tends to tarnish *Mace Gold*.

## PC Tools Deluxe

Without exiting Version 5 of *PC Tools Deluxe*, you can create files using a built-in word processor, send them to another computer via a built-in communication module, encrypt them, delete them, recover them, and unfragment them. It won't surprise you that you can also back them up and restore them using one of the ambitious utilities that make up Central Point Software's \$79 do-everything package.

You might almost consider buying *PC Tools Deluxe* for the PCBackup component alone. This efficient program can be run independently or be called up from the shell program that serves as a core and command post for the rest of the package. If you use the shell program, you can use *PC Tools'* built-in keyboard macro functions to replay a sequence of backup commands too complicated to store as a single configuration—for example, backups of multiple drives. Command-line parameters can't be used to control the program in the current version.

However you run PCBackup, you get a fast, well-integrated program that uses a mouse or keyboard interface and can back up and restore to any DOS device. Help is always at hand at the press of a key. With standard floppy disks, the program uses a proprietary format not readable by DOS. With cartridge disks, tape drives, or any other device—and optionally with floppy disks—DOS's format is used instead. In-

### FACT FILE

**Mace Utilities Gold Edition, Version 5.0**  
Paul Mace Software,  
400 Williamson Way,  
Ashland, OR 97520  
(800) 523-0255, (503)  
488-2322  
List Price: \$149  
Requires: 512K RAM,  
hard disk, DOS 2.0 or later.

**In Short:** The package's backup-and-restore programs are moderately fast and moderately awkward. Although there are plenty of options, there are no directory displays to ease the task of selecting files and directories to back up and restore.

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## SOFTWARE BACKUP



PC Tools Deluxe offers an extremely elegant screen to look at while backing up and doesn't bother you with information you can't use. As it works its way through, the moving highlights in each part of the screen indicate the file currently being backed up.

cremental backups must be saved to a new disk rather than appended to the last disk of an earlier set. Even when PCBackup uses DOS's format, it combines all the files on a backup disk into a single gigantic file rather than reproducing DOS's directory structure. Only PCBackup can restore backups that it creates.

You can back up or restore a full disk with a few keystrokes, or you can specify almost any subset of files based on date ranges, attributes, wildcards, or brute-force selections of individual files. Most of the informative screen is normally filled with a two-window display of directories and files, and you can select files simply by moving the cursor to the directory or filename, then clicking the mouse or pressing Enter. Alt-key shortcuts let you start backup or restore operations at any time without wading through further menus.

Any configuration of files that you want to save or restore can be stored and later called up from a directory. Configurations can also include such sophisticated options as backing up to a 360K disk in a 1.2MB drive—although PCBackup, probably wisely, doesn't try some of the fancy tricks of other programs that use unusual formats, like forcing a 360K disk to accept 720K of data.

PCBackup handles errors with considerable flair. When confronted with a floppy disk with a hole punched in it, it bravely tried to format the disk, locked out the non-existent sectors, and continued with the rest of the backup. Like most backup programs, it warns you before overwriting a file when restoring, but unlike many other high-speed programs, it won't demolish a floppy disk full of data without asking permission.

Restoring files with PCBackup is relatively simple, but could be simpler. The program maintains no log on the hard disk, so it needs to get the backup catalog from the last disk of your backup before it starts a restore. Then, when you select the files you want to recover, you are prompted for the correct disks in turn. If the disk with the catalog is missing or damaged, you can recover everything else by feeding in all the remaining disks one by one, which will allow the program to rebuild the catalog, and then feed the disks in once again so that the program can copy files. A log on the hard disk would take up some valuable space but would avoid all the disk-swapping.

The first release of this version of PC Tools Deluxe suffered from some minor quirks. The most annoying was its refusal

### PC FACT FILE

**PC Tools Deluxe,**  
Version 5.1  
Central Point Software,  
15220 NW Greenbrier  
Place, #200,  
Beaverton, OR 97006;  
(503) 690-8000.  
List Price: \$79  
Requires: 512K RAM,  
hard disk (320K EMS recommended), DOS 3.0 or  
later.

In Short: PC Tools Deluxe's backup module is a fast, elegant program with a long list of options and a clear and easy-to-use menu. A backup log on the hard disk could make restores slightly easier to manage.



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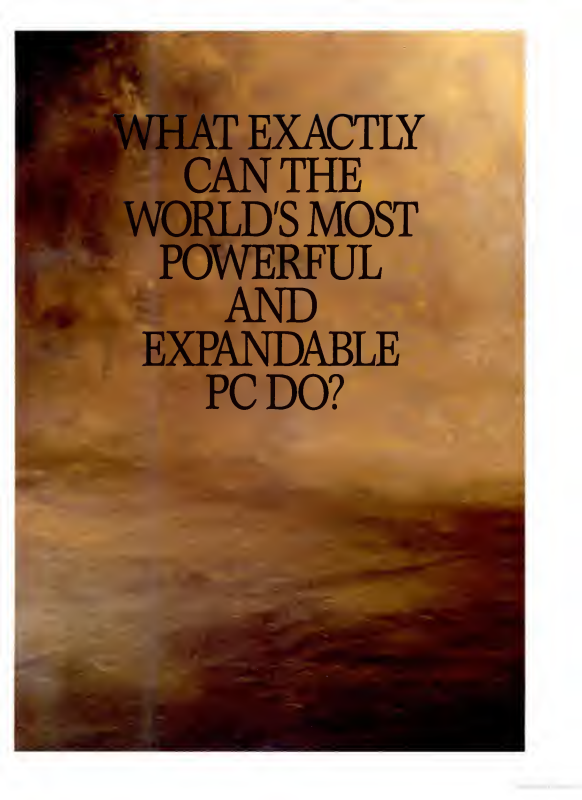
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## Point-and-Shoot PC-FullBak

Depending on how quickly you speak, it can take longer to say the name of Westlake Data Corp.'s \$129.95 backup program than it does to use it.

As soon as you press a couple of keys, *Point-and-Shoot PC-FullBak* rushes from the gate, backing up files as if there's no tomorrow. Any disk that happens to be in your floppy disk drive immediately gets overwritten with data—even a disk that you've mistakenly inserted from another backup set. Before you catch your breath, the program is prompting you for a second disk, and in no time at all your backup is finished. If your reflexes are razor-sharp and you don't waste time staring at the well-designed screen, you may be able to label the disks as quickly as the program uses them.

*Point-and-Shoot PC-FullBak* was among the fastest backup programs, but only when fed disks that it had already formatted to its own specification—which means that DOS can't read them. When the program encounters a disk that it hasn't formatted, it does so without asking permission, and there's no option that forces it to ask you. But the program handles errors with total aplomb. When we gave it a damaged disk, it calmly marked off the bad sectors and proceeded to use the rest of the disk without difficulty. Few other programs displayed such savoir faire.

The current version of *Point-and-Shoot PC-FullBak* evolved from a leaner version called *PC-FullBak*, which is still bundled

with hard disks sold by CompuAdd Corp. but cannot be bought separately. The current program comes in two flavors, both included on the same disk. A program called FBEZ offers only a few basic options on its one menu: back up all files or new files, compare backup and source, and restore. For most archival backups, these are all the choices you need, and if you have more than one hard disk partition, the menu conveniently lets you work your way from the first to the last. A further option to back up a preset file list only functions after you've used the more elaborate program called Fullbak. FBEZ is in fact a front end that lets you select simple options that are put into effect by the real backup program, Fullbak.

Fullbak, which uses Lotus-style menus, lets you back up groups of files or directories and create file lists for later use via Fullbak or FBEZ. It also sets defaults, including one that lets you use disks beyond their specified capacities. One menu option lets you save a few milliseconds by dispensing with the advance estimate of the number of disks needed for a backup. Some options, including one to back up all files created after a certain date, aren't on the menus at all but must be specified as command-line parameters when running the program. The directory screen displays only normal and read-only DOS files, not hidden or system files. If you want to back these up, you need to choose the option to back up the entire disk. The DOS system files are never backed up, no matter which option you choose.

When you point and shoot on the directory screen in *Point-and-Shoot PC-Full-*

*Point-and-Shoot PC-FullBak* doesn't hold back on anything when you back up. It reminds you which options you choose for the backup, how much time the program spent waiting while you fumbled for a disk, which files are about to be backed up, and which ones were already processed.

## FACT FILE



**Point-and-Shoot PC-FullBak**, Version 3.02  
Westlake Data Corp.,  
P.O. Box 1711, Austin,  
TX 78767; (512) 328-  
1041.  
List Price: \$129.95  
Requires: 384K RAM,  
hard disk, DOS 2.0 or  
later.

**In Short:** *Point-and-Shoot PC-FullBak* is one of the absolute speed champions among backup programs when it comes to backups to preformatted disks, and its menus and options are fast and easy to navigate. It also offers excellent error correction.

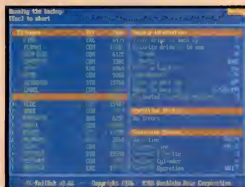


CIRCLE 408 ON READER SERVICE CARD

*Bak*, you probably will want to use more options than the menu tells you about. By reading the menu, you learn that you use the Spacebar to select a directory or file to back up. But only the manual reminds you to use the Ins key to see all of the files in a directory, or the / key to select only the files in a directory and not its subdirectory, or the \* key to select all files with the same extension as the one under the highlight. Don't press F1 for a reminder, because there's no help to be found under that or any other key.

When you use Fullbak, you can force the program to append the new or incremental backup to the space left over on the last disk of a previous backup. This feature can save acres of disk space on 1.2MB and 1.44MB disks and is uncommon among programs that use proprietary formats. Because of that proprietary format, you can back up only to floppy disk drives. You can't use an external floppy disk drive whose letter is higher than the letter of your hard disk, because with those devices DOS doesn't allow the direct control of the hardware that makes proprietary formatting possible.

*Point-and-Shoot PC-FullBak* maintains an extensive log file that it uses for selective restores or for selective verification of individual files on backup disks. When you want to restore a file, a window on-screen lets you scan through a complete list of all your backups, which are identified by date and time. You mark the file and backup date you need, and the program tells you which disk to insert for the restore.



## QuikSave

The name of this program applies both to its backup procedures and its style. Micro Interfaces Corp.'s \$99 *QuikSave* doesn't make you waste time or keystrokes. Almost at the instant you enter **QUIKSAVE** at the DOS prompt, a menu screen displays your current default options, and all you have to do is press Enter to start backing up. You don't get any warnings or prompts, even when you insert a disk from a previous *QuikSave* backup—although the program recognizes earlier disks from the same backup. *QuikSave* roars through a backup or restore at close to the top speed available today, but if you get impatient anyway and decide to interrupt the backup, just press the Esc key. The program doesn't pause to ask whether you really want to leave but instantly drops you back into DOS without further ado.

As long as you don't make mistakes like inserting the wrong disk or touching Esc at the wrong time, *QuikSave* won't make mistakes either. Give it a bad disk in the middle of a backup and it doesn't collapse the way some of its rivals do. It rejects the disk with a beep of disgust, asks you to insert another, and proceeds without further incident. The only situation that confuses it badly is a shortage of memory in your system. If for some reason you try to back up with memory reduced by a large TSR or some other circumstance, the program flings garbage onto your screen and beeps loudly, but it finally exits to DOS without locking up.

With better-designed screens and better user conveniences, *QuikSave* would be

one of the world's backup champions. When you want to mark files or directories to include or exclude when backing up, you have to type in their names by hand. There's no directory listing to help you mark them or remember what they are. Although the menu conventions in the program are generally consistent, they're also somewhat arbitrary. The Enter key often takes you to the next menu, never to the next line. Sometimes you can overwrite an entry, sometimes you have to press Enter as a toggle. One thing you can be sure of is that Esc will get you out of wherever you are—fast.

The main menu has room to display a group of separate backup configurations, so that files associated with different tasks or different users can be backed up separately. Each configuration has its own set of include and exclude files, and each has its own setting for the number of days recommended between backups. Best of all, each configuration can include files and directories on two or more hard disks.

If you let *QuikSave* modify your AUTOEXEC file to install a file that keeps track of backups, your screen will be filled with an enormous warning whenever you boot after letting one of those recommended intervals go by. A couple of keystrokes take you to a list of files that need backing up or directly to the main backup program. You can exit without backing up, but you'll be blasted by that same warning the next time you turn on the machine.

You can only restore or verify *QuikSave* disks using programs that come with *QuikSave* itself. The backup disks use a proprietary format unreadable by DOS,



FACT FILE

**QuikSave**, Version 2.41  
Micro Interfaces Corp.,  
18590 NW 67th Ave.,  
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(800) 888-8086, (305)  
823-8088.

**List Price:** \$99;  
discounts for multiple  
purchases are  
available.

**Requires:** 256K RAM, DOS 2.0 or later.  
In Short: *QuikSave* is ultra-high-speed no-nonsense backups cause no delays at all, although the sometimes-confusing interface can be a barrier to quick action. An automatic scheduling program presents a full-screen warning when backups are overdue.

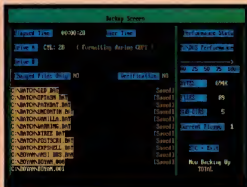
CIRCLE 408 ON READER SERVICE CARD



but a catalog on the hard disk preserves a record of your backups, complete with the number of the disk containing each file. A search function lets you enter a file specification and lets the program search for all occurrences of the specification in the backup catalog. Unfortunately, you can't mark files in this catalog and let the program retrieve them for you. Instead, you switch to another part of the program, insert the backup floppy disk, and let the program read a directory from the floppy disk itself. Here you can tag the files to be restored and let the program go to work.

These directory screens, like other menus in the program, are more awkward than they need to be. In the screen that shows the catalog on the hard disk, PgDn and PgUp move from floppy disk to floppy disk, but the Home and End keys merely beep when pressed. In the screen that displays the directory from the floppy disk, Home and End are used to mark files for restores, while the PgUp and PgDn keys take over the job of beeping exclusively. In both screens, you can use the Arrow keys for a slow but silent journey through the lists of files. If you choose a total restore, you don't have to bother with any of this.

You can tell *QuikSave* to prompt you before overwriting files during a restore, and you can specify exactly which circumstances call for prompting and which should be avoided altogether. You can tell the program exactly what to do when it encounters hidden or read-only files—or files dated later than your most recent backup. *QuikSave* knows that you're in a hurry to get your files onto your backup disks but that you may want to pause for reflection before putting them back.



*QuikSave* reports on its progress but doesn't tell you how much longer you'll have to wait. The "performance" indicator tells the speed of file transfers; IBM machines and true compatibles should always reach 100 percent. "User time" is the time you make the program wait for a new disk.

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## TakeTwo Manager

Give this program some vitamins and a new suit of clothes and you'll have something really impressive. United Software Security's \$139 combination backup utility and file manager is slow and sober, and it can make itself welcome in the office through its ability to schedule full backups at regular intervals while performing partial backups at other times. It comes with a separate file manager and undelete program that can be installed in memory and popped up over applications. Yet compared with more-up-to-date programs, *TakeTwo Manager* is burdened with an awkward interface, baffling menus, slow speed, and error-detection techniques that spring into action only when it's too late to rescue lost data.

When you install *TakeTwo Manager*, it sets up a directory for itself and a separate directory for its history files, then immediately asks if you want to back up your disk. If you do, the program jumps to a menu that quickly displays a summary of the backup and prompts you to insert a disk labeled with one of the printed labels provided in the package.

If the disk isn't formatted, the program first asks you whether you want to format it, then invokes DOS's *FORMAT*, which tells you to insert the disk that you've already inserted. When *FORMAT* is finished, it asks you if you want to format another disk, and if you say no, you are brought back to the *TakeTwo* menu, where you must press Enter one more time before the backup will proceed.

You may find all this excess prompting

tolerable when you discover that *TakeTwo Manager* compensates for it with a feature that automatically resumes an interrupted backup. It doesn't matter if you voluntarily escape out of a backup via the menus or if the power company abruptly pulls the plug. The next time you run the program, it starts by prompting you to continue the backup where it left off. Because *TakeTwo Manager* is one of the slower backup programs, this is a feature you may have to use often.

By default, *TakeTwo Manager* backs up all your files during a full backup and any modified files during a modified backup. You can choose either variety of backup at any time, but you should probably pick a third, "automatic" option and let the program decide for itself which type of backup to perform. The program arrives at its decision based on its settings for the regular interval between full backups, the number of files changed since the last backup, and the number of floppy disks allocated to a backup "pool" that is continuously recycled. Default settings are built in but can be changed via a moderately confusing menu.

You can complicate matters further by using an optional backup recycling system that lets you divide your files into different classes. "Once-only" files are backed up once to a lettered series of disks and are never backed up again—not even during a full backup unless they are altered. "Regular" files are files that are regularly backed up to numbered disks. These are always backed up during a full backup, but whether or not they go into a "modified" backup depends on which of two subcate-

PC  
MAGAZINE

FACT FILE

### TakeTwo Manager.

Version 2.10  
United Software  
Security Inc., 8133  
Leesburg Pike, Vienna,  
VA 22182; (800) 892-  
0007, (703) 556-0007.  
List Price: \$139  
Requires: 256K RAM,  
DOS 2.1 or later.

In Short: *TakeTwo Manager* has useful backup scheduling and easy restores, but it also has an awkward interface, limited speed, and weak error-detection functions.



CIRCLE 418 ON READER SERVICE CARD

gories you place them in. You can mark them to be backed up as soon as they are altered or only after a specified interval of 1 to 60 days. You will find that it's a lot easier to use this system than it is to figure it out from the information scattered around the manual.

*TakeTwo Manager's* backup disks contain DOS-readable copies of your files, but they are kept in directories whose names have no relation to the directories on your hard disk. If you don't have a copy of *TakeTwo Manager* at hand to rebuild your disk automatically from the floppy disks, you can still recover your files by using ordinary DOS commands, but you'll have to reconstruct the original directory structure from memory.

*TakeTwo Manager* uses well-designed backup catalogs for menu-driven restores. When you want to retrieve a file from the backup disks, a screen displays a list of everything you've backed up, complete with the date. You just press a function key to mark the file, press another function key to start the restore, and a prompt tells you which disk to insert in the drive. Unless you've changed the configuration, you'll be prompted before overwriting anything on your hard disk.

PC Labs got an unpleasant surprise when we slipped a deliberately defective disk to *TakeTwo Manager* during a backup. The program unhesitatingly wrote our files to the bad sectors on the disk. Only when we tried to restore the files did *TakeTwo Manager* notice that they weren't on the backup disks. You can avoid most problems like this by using an option that turns on DOS's rather weak *VERIFY* function when backing up, but

### As TakeTwo

*Manager* works its way through your hard disk, it displays the number of the floppy disk it is using. The name of the second floppy disk is changing color to indicate the amount of the disk now filled. Gray areas represent remaining disks.



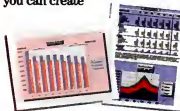
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## EDITOR'S CHOICE

- Fastback Plus
- Intelligent Backup

Backup programs now perform wonders that were barely imaginable when IBM and Microsoft introduced backups to the PC with the XT and DOS 2.0.

*Fastback Plus* (\$189) formats floppy disks and backs up files with breathtaking speed to anything writable that uses a drive letter. Its range of options covers every conceivable backup strategy, and its macros let you run the most-complicated backups with a few keystrokes. Its clean, elegant interface makes it a pleasure to use, and it shrugs off disk errors with admirable ease. In offices, the advanced macro language can be used to create menus and messages that prompt unsophisticated users through this most sophisticated of backup programs.

*Intelligent Backup* (\$149.95) emphasizes a completely different way of preserving data. Instead of accumulating and sometimes reusing backup disks, as you would with *Fastback Plus*, *Intelligent Backup* automatically creates a "pool" of disks that it recycles when necessary in order to maintain up-to-date backups that can be restored quickly. This isn't one of the fastest backup programs, but in many situations it can be the easiest to use. Every backup program should be able to restore individual files in seconds after you enter the filename as a command-line parameter. But *Intelligent Backup* is the only program that can.

the manual warns that this will slow your backups by 40 percent.

Because *TakeTwo Manager's* backups are slow even with *VERIFY* switched off, you may want to think hard about your priorities before deciding which setting to choose. ■

Edward Mendelson is a contributing editor of PC Magazine.

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EDITOR'S CHOICE  
June 1986

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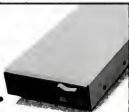
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\* EDITOR'S CHOICE 9/15/86



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Building Workgroup Solutions

# AT&T StarLAN 10

by Frank J. Derfler, Jr. and Paul Ferrill



ILLUSTRATION: JOHN WILKINSON

**AT&T's new StarLAN 10 and StarGROUP bolster the company's position through conformity to standards, operational features, support, and integration with higher-level computers.**

AT&T has a long history in the telephone business, so it's no surprise that the company's solution to PC networking is based on telephone (twisted-pair) wiring. At transmission speeds of 10 megabits per second, the AT&T StarLAN 10 system—including the new StarLAN hardware and *StarGROUP* software—links DOS-based PCs and integrates them into Unix-based networks.

Flexible, reasonably priced, and easy to install, StarLAN's earlier versions showed that the system can perform with all the throughput required by PC-based networks, even at 1-

Mbps rates. Today, StarLAN 10 and its accompanying software form a complete system that, in the PC LAN Labs benchmark tests, approaches the throughput of competing systems like Novell's *NetWare* and 3Com's *3+Open LAN Manager*.

#### POPULARITY OF UNIX

As was the case with the telephone, the growing popularity of the Unix operating system can mean only good news to AT&T. Unix, after all, has its roots within AT&T. About 20 years ago, the switches and control units AT&T used to

deliver long-distance telephone service and high-speed communications circuits were computerized. AT&T engineers and computer scientists working with these telephone switching systems determined that a program-development environment would make their efforts more productive. And so the Unix operating system was born.

Initially, AT&T went to companies like Digital Equipment Corp. (DEC) for computer hardware; the Unix operating system

was written for one of DEC's early machines, the PDP-7. The earliest work on Unix was done in 1969-1970, primarily by Dennis Ritchie and Ken Thompson of AT&T Bell Labs. The Unix system was completely rewritten in 1973 using the newly developed C programming language.

Because of its legal monopoly on telephone systems in the U.S. at that time,

AT&T was prohibited by the FCC from selling computer products. So the company made the operating system available at no cost to colleges and universities. It was a wise decision, providing a strong technical base for the system. The early exposure of entry-level computer scientists to Unix has certainly added to its growing market today.

#### GETTING INTO THE ACT

After the FCC Computer II and court-ordered divestiture actions of the mid-1980s, AT&T was allowed to enter the computer retail business. But the company's computer hardware sales operation got off to a slow start, particularly in the U.S. retail market. Many blame AT&T's initial lack of retail success on in-house management turmoil; they also point to AT&T's reliance on Olivetti-designed PCs that weren't popular with American reviewers or users.

You can still buy 4-year-old versions of AT&T Unix computers from resellers at bargain-basement prices. With the notable exception of a huge government contract, its current lines of 3B2 minicomputers have not been able to make a sizeable dent in the market currently owned by DEC, Data General, Hewlett-Packard, Wang, and IBM.

This market resistance, however, could subside. AT&T's new StarLAN and StarGROUP offerings (StarGROUP is the name given to all nonhardware products—the software can be bought on its own), combined with its Unix expertise, give the company a strong position in the emerging systems-integration market. AT&T offers the major things people buying PC-based LANs and integrated computer systems want: conformity to standards, operational features, support, and integration with higher-level computers.

#### STARLAN AND STANDARDS

AT&T is not alone in offering solutions based on twisted-pair wiring. Soon after the company developed the StarLAN concept, other companies announced similar twisted-pair products. For a complete review of high-speed twisted-pair LANs, see "Making Connections: Fast Performance over Telephone Wire" (*PC Magazine*, September 13, 1988).

The name StarLAN refers to the network wiring and signaling architecture created by AT&T that uses CSMA (Carrier-Sense Multiple Access) protocols over twisted-pair wire. The AT&T StarLAN system comes in two different flavors: 1



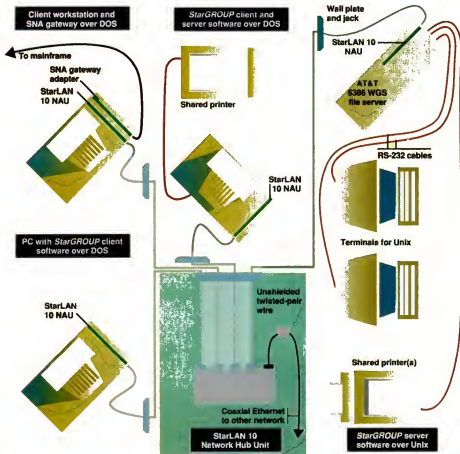
Designed primarily to run Unix, the 20-MHz, 386-based AT&T 6386 WGS proves the ideal server for the company's StarLAN 10 network, with its ability to handle AT&T's StarGROUP software (not shown) as a Unix application. The StarLAN 10 Network Hub Unit (NHU; inset) links the 6386 WGS and its Unix terminals with PCs running DOS-based client software that pass requests to the server. Installed in each PC and the 6386 WGS is a StarLAN 10 Network PC NAU adapter. In addition, one jack on the NHU allows connection to existing coaxial-based Ethernet networks; the other jacks accommodate twisted-pair wiring.



# AT&T STARLAN TOPOLOGY

The AT&T StarLAN 10 has a hub-type topology that matches the wiring-closet and distribution-panel wiring architecture used for telephones—and utilizes the same unshielded twisted-pair wire found in modern telephone installations. The Network Hub Unit, usually located in the telephone wiring closet, is here linked to the AT&T 6386 WGS computer, which runs the *StarGROUP* software as a Unix application. As a result, application

programs running on networked PCs fitted with Network Access Units, or NAUs, can share files with Unix applications. In addition, a version of the *StarGROUP* server software for DOS lets a PC simultaneously act as a client to the 6386 WGS and as a local disk and file server. Other stations on the network can also function as SNA (Systems Network Architecture) or X.25 gateways, as shown.







## BENCHMARK TESTS: AT&T STARLAN 10

The AT&T StarLAN 10 system—StarLAN 10 hardware and *StarGROUP* software—doesn't handle small data blocks with the speed of Ethernet and *NetWare* because it relies on Unix instead of a specialized operating system. But StarLAN 10 does offer compatibility with Unix application software—and gigabytes of contiguous data storage.

The PC LAN Labs benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC in a typical heavy-use environment (such as a data-entry operation). We have designed these tests so that a single station represents five to ten times the load of a user performing an interactive task (such as updating records) on a typical network.

The Network Throughput Under Load, Hard Disk Access Load, and Database Load benchmark tests each report the throughput recorded during the performance of a standardized task on the network. To

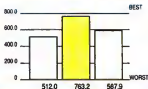
obtain the figures shown here, we run a test program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate among 16K, 4K, and 512 bytes. Usually a 1MB file is used, but this size may be adjusted for unusually fast or slow networks.

While the general test program is run, we load the network with specific programs for each of our three benchmark tests. The results shown represent the average throughput over a period of time sufficiently long to ensure consistency.

### Network Throughput Under Load

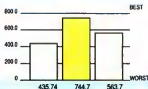
#### Zero stations

Throughput ↑



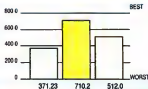
#### One station

Throughput ↑



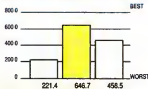
#### Two stations

Throughput ↑



#### Three stations

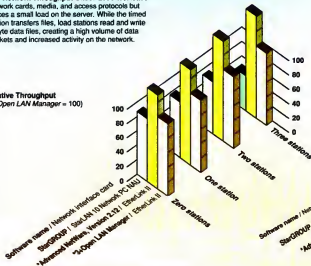
Throughput ↑



## NETWORK THROUGHPUT TESTS: COMPOSITE VIEW

The Network Throughput Under Load test loads network cards, media, and access protocols but places a small load on the server. While the timed station transfers files, load stations read and write 1-byte data files, creating a high volume of data packets and increased activity on the network.

Relative Throughput  
(3+Open LAN Manager = 100)



\* These products were not reviewed, but we ran tests on them for comparison.

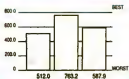
↑ Kiloits per second.



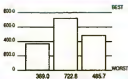
# BENCHMARK TESTS: AT&T STARLAN 10

## Hard Disk Access Load

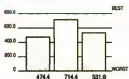
Zero stations Throughput 262



Two stations Throughput 1



One station Throughput 262



Three stations Throughput 1



Software name /  
Network interface  
card

StarGROUP / StarLAN 10 Network PC HW

Advanced Hardware, Version 2.12 / EtherLink II

StarGROUP / StarLAN 10 Network PC HW

Advanced Hardware, Version 2.12 / EtherLink II

StarGROUP / StarLAN 10 Network PC HW

Advanced Hardware, Version 2.12 / EtherLink II

Software name /  
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Advanced Hardware, Version 2.12 / EtherLink II

StarGROUP / StarLAN 10 Network PC HW

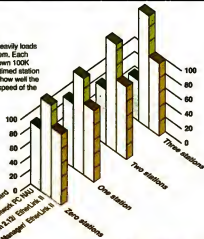
Advanced Hardware, Version 2.12 / EtherLink II

↑ Kbytes per second.



## HARD DISK ACCESS LOAD TESTS: COMPOSITE VIEW

The Hard Disk Access Load test heavily loads the hard disk and disk-caching system. Each load station randomly accesses its own 100K data file using 1K records while the timed station transfers files. This procedure tests how well the software handles the drive and the speed of the disk subsystem.



Relative Throughput  
(3x-Open LAN Manager = 100)

\* These products were not reviewed, but we ran tests on them for comparison.

CONTINUES

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# BENCHMARK TESTS: AT&T STARLAN 10

Because *StarGROUP* runs as a process under Unix, the file-management software must pass requests to the Unix operating system for response. This process—and the fact that the Unix file system isn't designed for fast response—results in a lower throughput rate than we obtained with Novell's Advanced NetWare or with 3Com Corp.'s 3+Open LAN Manager running on fast servers and using thin Ethernet. The throughput for StarLAN 10 hardware and *StarGROUP*, however, remains better than 90 percent of the network systems we have tested in the past.

As data file operations are being performed, our LAN benchmark tests rotate among 16K, 4K, and 512-byte records, and we found that the StarLAN 10 system particularly slows down on the smallest record size. On larger-record retrievals, it is as fast as the Novell and 3Com systems; this pace is typical of the PC server programs we've seen that run over multiuser operating systems.

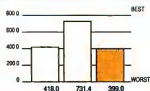
AT&T's *StarGROUP* software was tested in a typical configuration using the AT&T 6386E WGS as a server. The other two systems used the IBM PS/2 Model 80.

## Database Load

### Zero stations Throughput †



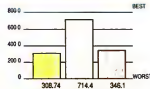
### One station Throughput †



### Two stations Throughput †



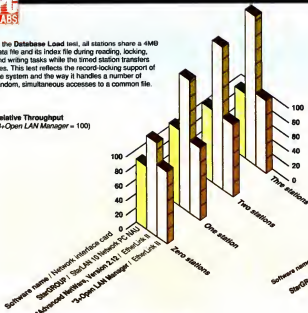
### Three stations Throughput †



## DATABASE LOAD TESTS: COMPOSITE VIEW

In the Database Load test, all stations share a 4MB data file and its index file during reading, locking, and writing tasks while the timed station transfers files. This test reflects the record-locking support of the system and the way it handles a number of random, simultaneous accesses to a common file.

Relative Throughput  
(3+Open LAN Manager = 100)



\* These products were not reviewed, but we ran tests on them for comparison.

† Kilobits per second.

END

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EDITOR'S CHOICE  
G/Ethernet AT  
January 31, 1989

PC  
MAGAZINE

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# CONNECTIVITY

## AT&T STARLAN 10

Mbps and 10 Mbps. The 1-Mbps system has been available for several years, and though our tests in the PC LAN Labs always showed its speed to be enough for most PC applications, it never sold well. Neither AT&T's marketing nor our testing could convince the people who buy networks that 1 Mbps is a sufficiently fast transmission speed.

AT&T's new 10-Mbps StarLAN 10 system conforms to the draft version of the 10BaseT standard prepared by the IEEE (Institute of Electrical and Electronics Engineers). The 10BaseT IEEE designation refers to a 10-MHz baseband network uti-

lizing twisted-pair wire; the standard describes the types of signaling and kinds of connectors used and the configuration of the wiring system.

The appeal of this distribution scheme is that most buildings already have a modern telephone system in place. Most phone systems have the two extra wire pairs needed by 10BaseT-conforming LAN hardware, so anyone with such a system is already wired for this type of network. The 10BaseT standard, however, makes real economic sense only if the telephone wir-



## LAN OPERATING SYSTEMS: SUMMARY OF FEATURES

This table provides a look at how well AT&T's StarGROUP stacks up against its competition from 3Com Corp. and Novell. The list of features was chosen to emphasize differences among the products.

	StarGROUP AT&T	Advanced NetWare, Version 2.12 Novell Inc.	3+Open LAN Manager 3Com Corp.
<b>GENERAL INFORMATION</b>			
List price	\$1,295 (8 users)	\$2,695 (100 users)	\$2,995 (unlimited users)
Peer-to-peer resource sharing	●	○	○
Dedicated server required	○	●	○
<b>SERVER SOFTWARE</b>			
Operating system	Unix	Proprietary	OS/2
Minimum RAM required	7MB	640K	4MB
Maximum number of cards bridged	2	4	4
Accepts Token-Ring cards	○	●	●
Accepts Ethernet cards	●*	●	●
Accepts ARCnet cards	●*	●	●
<b>WORKSTATION SOFTWARE</b>			
Compatible with OS/2 workstations	○	●	●
RAM consumed by DOS workstation	24K-150K	15K-35K	105K-197K
<b>NETWORK ADMINISTRATION</b>			
Keeps historical error/status log	●	●	●
Accrues costs by resource	○	●	●
Suspends workstation on error	●	●	●
Reports bad packets and errors	●	●	●
<b>SECURITY</b>			
Access contingent on group membership	○	●	●
Access contingent on password	●	○	●
Access contingent on date and time	○	●	○
<b>PRINTER SHARING</b>			
Print spool hunts for appropriate printer	●	●	●

●—Yes ○—No

\* StarGROUP accepts cards of this type from a limited number of vendors.

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CONNECTIVITY  
AT&T STARLAN 10

ing in your building is well documented, which is not often the case. If the wiring is such a mess that you will need a new installation anyway, then the only advantage of a 10BaseT setup over a system like Token-Ring is the low cost of the wire itself.

AT&T is a member of the IEEE committee working on developing the final 10BaseT technical specification (its StarLAN products conform to the current draft standard), which ensures that its interests will be well represented. The 10BaseT draft specification is about to go to a letter ballot and could become an IEEE standard as early as December 1989. AT&T plans to update its hardware to ensure compatibility with the standard in its final, approved form.

#### HARDWARE OFFERINGS

AT&T's latest hardware offerings include the AT&T 6386 WGS (Work Group System). This machine is a little larger than an IBM PS/2 Model 80, uses a 20-MHz 80386 processor, and has AT-style expansion slots along with special slots for 32-bit memory. The 6386 WGS lacks the rough edges, particularly in its interior layout and design, that were so evident in the

early AT&T products. Our test machine—with 4MB of RAM and an 80MB hard disk—costs slightly over \$8,200.

AT&T designed the 6386 WGS to run the Unix operating system. As such, it is a full-blown multiuser/multitasking computer system capable of handling many terminals. But the 6386 WGS can act as the backbone server machine in a *StarGROUP* network of PCs, providing capabilities on a par with Novell, 3Com, and Banyan networking systems; this is an important point for PC system designers.

#### CONNECTING THE COMPUTERS

To cover all the types of computers that might attach to a StarLAN 10 LAN, AT&T developed a number of different network interface devices. For PS/2 machines, a \$495 MC100 NAU (Network Access Unit) is used with an AUI (Attachment Unit Interface) adapter. The \$495 PC NAU is the primary interface for PC- and AT-type computers. The adapter for the PC AT bus is a circuit board with direct plug-in connections for the telephone wire. It doesn't need the external trans-

ceiver used on AT&T's Micro Channel board or found in some versions of the competing 10-Mbps twisted-pair products. Adapters for AT&T's other computers, including the 3B2 minicomputer line, are also available.

StarLAN 10 features a hub-type topology that matches the wiring-closet and distribution-panel architecture used for telephones. All network connections run directly from a node to a Network Hub Unit. The \$1,895 unit provides 11 modular jacks and 1 Ethernet transceiver port. The Ethernet transceiver port allows connections for existing coaxial-cable-based Ethernet networks.

The Network Hub Unit performs other functions besides serving as a tie point for the client machines. It also provides amplification and retiming of network signals before it retransmits them. This lets you have up to 328 feet of wire between the hub and each node. The hub has lights that indicate whether the network is operating correctly and whether it is properly connected to the nodes, so it is also a valuable troubleshooting tool.

Other StarLAN 10 devices available from AT&T include an \$895 fiber adapter

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networking business  
20 years, so you  
can hook up a PC  
in a couple of minutes.





CONNECTIVITY  
AT&T STARLAN 10

that permits workstations to be up to 1 kilometer away from the hub; 1:10 and 10:10 network bridges that allow you to add more networks to the system; and an interface to the AT&T ISN (Information Systems Network)—a packet-switched system architecture for large installations.

#### STARGROUP SOFTWARE

AT&T wants to offer a comprehensive solution to any organization's networking needs; this means allowing the integration of a variety of machine types and a multitude of communications media. AT&T accomplishes this with its *StarGROUP* software for both Unix and MS-DOS systems.

While Novell's *NetWare*, Banyan's *VINES*, and 3Com's *3+Open LAN Manager* network operating systems can use many different kinds of network interface cards, *StarGROUP* supports only AT&T's network interface adapters and a few Ethernet adapters marketed by Ungermann-Bass and Interlan. *StarGROUP* does not support Token-Ring networks.

The Unix-based server software, *StarGROUP Software LAN Server* for Unix, runs on AT&T 3B2 and 6386 WGS machines under the Unix operating system, as

well as on computers that have compatible versions of AT&T's Unix V operating system, like IBM PS/2 and Compaq systems. The software and operating system require a minimum of 4MB of RAM.

A Unix-based server has several advantages over a DOS-based server. For one thing, the Unix machine can provide gigabytes of hard disk storage in large, contiguous files. Second, modern Unix- and DOS-based applications can share data files in the Unix-based server. Finally, the ability to create Unix shell scripts gives system managers and developers flexibility in controlling printers, gathering statistical data, and performing other maintenance functions.

On the average, Unix-based servers have much faster throughput than DOS-based servers like *LanTastic*, and *StarGROUP* is no exception. But *StarGROUP* still runs as an application under Unix; the file management software must pass requests to the Unix operating system for response. This, combined with the fact that the Unix file system isn't tuned for fast response, means that the throughput is slow-

er than that provided by products designed to service PC applications through proprietary operating systems, such as *NetWare*.

The Unix server program supports up to 64 DOS clients simultaneously, with up to 512 links to the server. In this mode, the Unix operating system is completely transparent to the DOS workstation user—the server looks like just another disk drive. While Novell can support 100 simultaneous clients, this is not necessarily an advantage—in most installations, several dozen active clients can keep a server's hard disk drives and network interface connections very busy.

#### MULTIUSER, MULTI-EXTRAS

Since the underlying Unix operating system has true multiuser/multitasking capabilities, many other features are included as part of the *StarGROUP* software package. Services like printer spooling and user-to-user messaging are done through Unix utilities. Devices on client machines, like attached printers, can also be made available to the network, freeing you from the need to attach all the network printers to the file server. This capability allows a user in one department to print a report on

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The administrator of the *StarGROUP* system controls the software from any DOS PC on the network or from any terminal communicating with the Unix side of the computer. Since any PC can log on through the network as a Unix terminal, it's simple for the administrator to enter the *StarGROUP* configuration program. *StarGROUP* (both the Unix and DOS versions) includes a software package called

*Menus* that you can load as an interface both for the administrator and for users. *Menus* helps the administrator manage user capabilities, file access, and printer functions.

You must spend a little more time configuring AT&T's *Menus* than you have to with similar products from Novell and Banyan, which automatically read factors

like server names from the environment. The process moves quickly, though. If you don't want to load *Menus*, you can control the network through a command language—it is not difficult to use, and AT&T's excellent manuals are a big help. Overall, the *StarGROUP* server software is simple to install and configure, through the *menus* or the command language.

The *StarGROUP* Software LAN Server for MS-DOS runs on PC hardware running MS-DOS 3.1 or later. It provides the same basic file and printer services as the Unix version, but it gives *StarGROUP* server capabilities compatible with MS-DOS machines. The software runs in either a dedicated or a nondedicated server mode, so a DOS system can service infrequent file and printer requests and still run DOS application software.

Network applications written to industry standards, including MS-DOS 3.1 or later and the NetBIOS programming inter-

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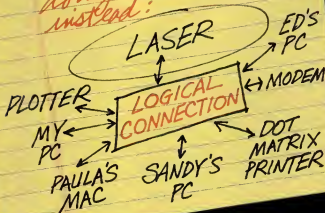
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you can control  
the network through  
a command  
language—it isn't  
difficult to use, and the  
manuals are a big help.

face of the IBM PC network, are fully supported. We didn't benchmark test the LAN server for DOS, but you can expect its performance to be on a par with IBM's *PC Local Area Network Program*: both put a layer of software on top of DOS to moderate multiple simultaneous requests for file service and pass the requests on to DOS one at a time. In both systems, DOS winds up as the bottleneck. The DOS server program is useful for providing workgroup-level file service as part of a larger organizational network.

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As for client software, the *StarGROUP*'s client component loads on any PC running DOS 3.1 or later. We ran it on Dell System 200 and Compaq Deskpro 386/20 computer systems. The package takes up 62K of RAM if you load it normally, but you can take advantage of expanded memory.

Client-station users can choose either menus or command-line entries to control links to the servers' resources. Administrators can automate the operation of the client systems with batch files.

#### SYSTEM ADMINISTRATION

You can manage *StarGROUP* from any workstation, but a complete set of console commands is available from the server's keyboard. A menu-driven program called *Interface* (Face for short) allows control over print-job queues and logged-in stations and produces excellent on-screen reports on server and printer activity.

The *StarGROUP* package comes with a program called *Windows Server Administration*, a special version of *Microsoft Windows*. If you don't like menus or a command language, you can mouse your way through the process of linking client

stations to network resources.

For security, *StarGROUP* uses the concept of "sharenames," common to many network operating systems, to identify and control resources shared across the network. A disk drive, subdirectory, or port is assigned a special sharename that designates

In real networks  
only a few resources  
usually need extra  
password protection.

the resource—the resource can also be given password protection. At individual workstations, a menu or command language links the local disk drive or port to the sharename.

Since passwords control each sharename, system administrators can have a

fine degree of security control. In theory, the control of many passwords can be a burden on the system administrator, but in real networks only a few resources usually need extra password protection. Novell's *NerWare* and some other network operating systems use a security system that associates a person's rights and privileges with membership in a workgroup rather than with access to a resource. Overall, the administrator's workload is about the same for both security plans.

#### A HOST OF OPTIONS

Optional 386 server packages include an asynchronous communications gateway that uses IBM's ACS protocol (see "Building Workgroup Solutions: Asynchronous Communications Servers," *PC Magazine*, May 16, 1989) and the network version of *CrossTalk XVI* for terminal emulation. An asynchronous communications gateway enables a remote DOS workstation to establish a dial-up or direct RS-232 connection with a network server. It also allows people on the network to share modems or other serial devices.

AT&T markets its own AccuNET X.25 network, so it isn't surprising that the *Star-*

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GROUP software has an optional X.25 gateway and router service.

The increasing popularity of Unix is convincing many companies to offer application software that can run on both a larger, Unix-based minicomputer system and on DOS-based PCs. One example of this is Informix's database package, which provides the means to create a true distributed database system. You can create data tables on a terminal through the minicomputer's multiuser operating system and then update them from a PC. Common file areas can be created that look like DOS files to the PC and Unix-type files to terminals attached to the host.

AT&T PMX/STARMail, a \$995 component of the AT&T Private Message Exchange (PMX) software family, brings DOS clients on StarLAN networks into a PMX network. This package can be tailored to meet the needs of any size workgroup. And gateways to IBM's DISOSS and PROFS and to HP, Wang, and DEC office systems are provided through AT&T Message Exchange. You can attach non-ASCII files to mail messages and send them across the network.

AT&T allows connections to IBM


**FACT FILE**

**AT&T STARLAN 10**  
AT&T, 1 Speedwell Ave., Morristown, NJ 07960; (800) 247-1212.  
**List Price:** AT&T 6386 WGS with 80MB hard disk, 4MB RAM, monochrome monitor, \$8,230; StarLAN 10 Network Hub Unit, \$1,895; StarLAN 10 Network Fiber Hub, \$2,895; StarLAN 10 Network PC NAL, \$495; StarLAN 10 Network Management NAL, \$895; StarGROUP Software LAN Server for DOS (eight users), \$625; StarGROUP Software LAN Server for Unix (eight users), \$1,295; AT&T PMX STARMail, \$995.  
**Requires:** For software, AT&T 386 or 6386 WGS running Unix, or IBM PC or compatible running DOS 3.1 or later.  
**In Short:** With a total, integrated solution—from wiring to software—AT&T offers a package for any business that wants to use existing phone lines for its LAN. The latest software includes menu-driven interfaces to the Unix operating system to ease the network administrator's job. Overall, it's a broad product line at competitive prices.

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mainframes through its AS/Gateway SBS, which offers low-cost access to SNA mainframes. The network gateway emulates 3274 type C cluster controllers, and

the networked PCs become 3278/9 terminals. Up to five sessions may be active from a single PC at any one time. (For more information on similar LAN gateway packages, see "Building Workgroup Solutions: LAN Gateways," *PC Magazine*, November 29, 1988.)

The administrator in charge of networks consisting of 100 or more nodes can manage the LAN's hardware and software using the *StarGROUP Software Network Manager*. The software supports such things as administration and reconfiguration of network nodes, monitoring of equipment status and performance, collection and reporting of data, and troubleshooting and problem isolation. The main functions of the network manager software are implemented using an Informix-based on-line database called the *Network Configuration Database*. This software will run on 3B2 or 6386 WGS machines.

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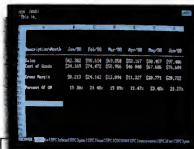
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the needs of the majority of users.

First, you get the industry-standard 90-day warranty, including a toll-free hotline for questions and advice and mail-in/carry-in replacement service for hardware problems. Basic warranty holders have access to the hotline during business hours. A 24-hour hotline number is available for extended-warranty holders.

Once the warranty expires, you can choose from among three types of service. One is essentially the same as the service supplied with the standard warranty, including weekday telephone support and mail-in hardware replacement. The second level type offers a 24-hour toll-free support number and field maintenance. The most comprehensive coverage includes AT&T's promise of a maximum 4-hour response time for a major failure and a 24-hour response for minor failures. All service work is done by AT&T-trained technicians operating from offices in most major metropolitan areas.

In addition to these service plans, AT&T provides two user-training courses (each costing \$1,100 per student) at facilities in Chicago, Philadelphia, and Sunnyvale, California. The first provides a tech-

nical overview of StarLAN; the second covers StarLAN network administration.

## WIRED COMPETITION

In the area of 10-Mbps twisted-pair systems, AT&T's main competitors are Hewlett-Packard, 3Com, and SynOptics Communications. HP offers a similar StarLAN 10-type product, including a \$695 PC Link and a \$2,995 StarLAN 10 hub. The HP OfficeShare software provides file- and printer-sharing services similar to the AT&T products.

SynOptics Communications' LattisNet has been shipping longer than the other competitors. It provides a unique option that allows direct connection to Apple Macintosh products. The PC part of the connection is accomplished via the \$495 Micom-Interlan N15210 LattisNet interface card. LattisNet Concentrators, which are comparable to StarLAN hubs, start at \$2,800.

3Com's PairTamer 10-Mbps wiring system is less expensive than any of the alternatives and uses only one wire pair. PairTamers run with any Ethernet cards.

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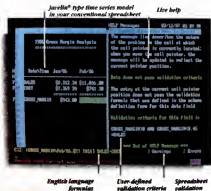
AT&T has staked a firm claim on the still-underdeveloped twisted-pair market with its StarLAN 10 hardware and *StarGROUP* software. Expect to see more companies looking for compatibility with a Unix-type environment migrating to AT&T's types of solutions—AT&T, after all, has many years of experience in the Unix system development area.

If you're looking for a company that can give you a total solution, from planning the wiring to fixing a bad interface card, look closely at AT&T. In these days of mergers, buy-outs, and bankruptcies, it's important to do business with a company that you can count on being there in the future. If past history is any indication, AT&T will be around for some time to come.

**Frank J. Derfler, Jr.**, is workgroup systems editor of PC Magazine. Paul Ferraro has degrees in electrical engineering from both the University of Alabama and the University of Florida. His articles have been published in the Proceedings of the IEEE and he has a wide range of experience in micro- and minicomputer systems.

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dea

by  
Winn L. Rosch

# Lab Notes

For many small offices, a PC on every desk is uneconomical and a network full of them is the stuff of which dreams are made. Reality calls instead for a system in which a group of simple terminals can operate as if they were full-fledged PCs simply by sharing the resources of a single, affordable computer.

In such situations, a multiuser, multitasking operating system such as *PC-MOS/386* can make an 80386-based computer a remarkably productive and efficient investment. Available from The Software Link, *PC-MOS/386* can give each of up to 25 users the ability to run his own regular DOS applications from a single machine and file system.

Of course, *PC-MOS/386* can also be used as an ordinary, single-user multitasking system. According to The Software Link, some 27 percent of *PC-MOS* purchasers opt to keep its power to themselves. The majority (63 percent) of its installations, however, are used to connect two to five users to one machine. The remaining 10 percent of its users stretch *PC-MOS* to up to 25 workstations.

A 386 computer can successfully link together everyone in a small office without the bother or expense of a network. But multiuser systems are inherently more complex than single-user PCs and their problems can be more serious. A simple error that usually means rebooting just your individual PC can leave two dozen people twiddling their thumbs if the multiuser system goes down.

Although getting your system to run smoothly can present initial difficulties, fortunately *PC-MOS* is nowhere near as overwhelming as Unix. In fact, it's hardly more difficult to start up than single-user DOS. The tips and tricks in this article will help you get going with fewer missteps and will help you make maximum use of the power in your 386 PC.

## MEMORY MATTERS

Compared even with DOS 4.0, *PC-MOS/386* at first appears to be awfully

## OPTIMIZING PC-MOS:

A hands-on  
introduction to a  
multiuser, multitasking  
operating system for  
the small office.

greedy: it commandeers about 170K of RAM. By exploiting the memory-paging abilities of 80386-based computers (and of 80286-based machines that have special memory-management hardware), however, *PC-MOS* can actually give standard DOS applications access to more RAM than would be available under DOS. In fact, in a few special circumstances you can even squeeze somewhat more than 640K into a DOS partition.

*PC-MOS* takes advantage of the same memory trick as do other 80386 operating environments. It remaps physical RAM into unused areas in the real-mode addressing range above the DOS 640K upper limit, shoehorning RAM between video memory and BIOS routines. *PC-MOS* then loads its own code into the remapped RAM. Under most circumstances, this keeps the bulk of *PC-MOS*'s code out of the DOS memory area, making more memory available to your applications.

Before booting up, *PC-MOS* tests various memory ranges to determine whether or not they are available for its use. These tests are not infallible, however, and they may either miss a usable range or cause *PC-MOS* to steal addresses needed by some other function. In the former case, the result is simply wasteful. In the latter case, the consequences can be devastating. An expansion board, for example, may use part of the high real-mode addressing

range as a swap area, and this fact may not show up during the boot-up memory check. If *PC-MOS* takes over this addressing range for its own purposes, your system will crash when the expansion board starts to access it.

Optimizing memory usage may thus require that you override automatic memory mapping and take direct control. You do this in *PC-MOS* by inserting up to five *FREEMEM* statements into your system's *CONFIG.SYS* file. Each *FREEMEM* statement explicitly specifies a memory range that is available for use by *PC-MOS*.

So if you experience persistent crashes, the first thing to do is turn memory mapping off (temporarily) by adding either of the following two lines to your *PC-MOS CONFIG.SYS* file:

```
FREEMEM=NONE  
FREEMEM=0
```

Either of these statements will tell *PC-MOS* not to remap any of its code into the real-mode high-memory area. It will then appropriate the RAM it needs from regular DOS addresses. Since this will drastically restrict the memory available for use by your applications, you'll only want to use this instruction for testing.

If your system does run with the above statement in *CONFIG.SYS*, then your difficulties in running *PC-MOS* were caused by remapping and you'll want to experiment by manually reassigning memory. Even if you have no problems with *PC-MOS*'s memory mapping, you may want to consider using manual mapping to get the most RAM out of your system.

For manual mapping, you only need to indicate the memory ranges available in your computer by listing each range after a *FREEMEM* statement in *CONFIG.SYS*. A typical entry would look like this:

```
FREEMEM=C0000, D0000  
FREEMEM=D0000, F0000
```

The first statement above tells *PC-MOS* to

## Lab Notes

start mapping at memory address C8000h—after the memory range used by a hard disk controller—and end at D0000h. (Note that all FREEMEM statements use hexadecimal notation.) In this example, a network adapter or some other device uses the range D0000h to D8000h, so the second statement gives *PC-MOS* the area between the network adapter code at D8000h and the beginning of the system BIOS at F0000h.

You may be able to squeeze a little more room out of your system by taking over the address range that IBM fills with cassette BASIC using the following CONFIG.SYS entry:

```
FILES=8000,7777
```

Preferring to err on the conservative side, The Software Link doesn't recommend using this area, but if you're careful and daring, you stand to reap a 32K reward.

*PC-MOS* also can take advantage of the ability of most 80386-based computers to address an extra 64K of wraparound memory that lies above the 1MB real addressing range. This area is available because of a difference between 8088 and 80386 microprocessors. The 8088 is designed to wrap around the first 64K addresses above its 1MB addressing limit, translating them to the first 64K segment at the bottom of memory. The 80386 recognizes such wraparound instructions as being in the 64K above the 1MB of real-mode memory. *PC-MOS* can normally supply close to 60K of usable addresses from this range.

In a number of 80386 systems, however, wraparound addressing works differently from the way *PC-MOS* expects, and this can cause unpredictable behavior. According to The Software Link, the Compaq Deskpro 386/20e, for example, is particularly prone to such problems. To accommodate such machines, *PC-MOS* provides a switch parameter that prevents the use of wraparound addressing. You can invoke this /C switch—which is currently undocumented—by adding it to the MEMDEV statement you use to set up the *PC-MOS* memory driver. Make the following entry in your CONFIG.SYS file:

```
MEMDEV=8386.838 /C
```

While the modular structure of *PC-*

*MOS* helps you make the most of the mappable memory above 640K, it does present one complication in terms of memory allocation. Various *PC-MOS* functions require contiguous blocks of memory. Fortunately, versions of *PC-MOS* since 2.30 have been designed so that their central kernels comprise two separate pieces that can be loaded into noncontiguous memory areas.



### IN-LINE CODE

◀ In issue 12, we introduced a new treatment of in-line code. From now on, we will tint *every other line* of code so you can easily distinguish one *complete line* of code from the next. If what should be a single-line entry on-screen is shown on two lines in the magazine, both lines will receive the same tint treatment. In addition, the number of spaces a secondary line is indented will indicate the number of spaces you should include when typing that multiple-line listing as a single-line entry on-screen. If a line is not indented, do not include any spaces.

However, *PC-MOS* requires a System Memory Pool (SMP) for housekeeping and for holding global drivers. The SMP size necessary for proper operation is determined by the number of simultaneous users and tasks that you wish to connect to the system. The memory allocation problem arises from the fact that *PC-MOS* always loads its various modules—including the SMP—in size order, with the largest first. They are packed one after another into the FREEMEM areas you've already designated. If a module doesn't fit within the contiguous RAM remaining in any FREEMEM area, *PC-MOS* will load that module's entire chunk of code into the 640K addressing range usable by DOS programs. This, in turn, will reduce the amount of memory available to every application that you want to run under the operating system.

### FINE-TUNING THE MEMORY POOL

The SMP often constitutes the largest block of memory that *PC-MOS* uses. Its default size is 64K, but exactly how large it must be depends on your system, the number of users sharing it, the number of tasks that are run simultaneously, and the number and sizes of device drivers that you load. You're never likely to approach the enforced size limit (440K for 80386-based computers), because if the SMP doesn't all fit into a high address range, it will subtract its size from the maximum RAM usable by any task.

More likely, then, you'll want to tinker with the minimum SMP size. You want to make the pool as small as possible so that you won't waste valuable address space. But you've got to be careful; make it too small and your system may freeze when it runs out of pooled memory.

You can follow either of two approaches when optimizing the size of the memory pool: calculation or confrontation. In either case, you need to start with a preliminary trial value. The default 64K setting is a good place to start, and you can explicitly request this pool size by adding the following line to your CONFIG.SYS file:

```
SMPSIZE=64
```

To alter the size of the system memory pool, substitute the number of kilobytes you want to use for the "64" in the example above.

To calculate the optimum SMP size, run the *MOS* utility's INFO option by typing the following at the system prompt after the system boots:

```
MOS INFO
```

This will display the memory assignments used by the system in hexadecimal notation.

If *MOS* INFO shows that the SMP is assigned to an address range below A0000h, you know that the preliminary pool size value is too large for the free addressing range available. From the values reported by *MOS* INFO and the FREEMEM assignments you've made, determine the largest addressing range available. If that range is at all close to the pool size you want to use, substitute its value in your SMPSIZE entry in CONFIG.SYS, reboot your system, and you're done.

If neither the pool nor any other part of *PC-MOS* is located below the A0000h boundary, you can safely and frugally en-



## Lab Notes

large the memory pool. Compare the address range you've assigned with FREEMEM to that used by the SMP and the rest of PC-MOS and assign whatever is left over in that range to the memory pool.

The drawback to using this scientific method to allocate memory is the need to perform a lot of hexadecimal math. If you rank hex calculations right up there with visits to the dentist, you can reboot your system several times instead of doing the arithmetic and still closely approach optimum memory assignment through simple trial and error.

To take this approach, start out with the default memory pool size and run CHKDSK, noting the amount of free memory.

Ideally, you should have about 600K; if there is substantially less, reduce SMPSIZE by about 4K. Available memory won't likely track the change in SMPSIZE directly, but at some point you'll find a dramatic increase in available memory. This change indicates that you've shrunk SMPSIZE so that it neatly fits into a contiguous memory area above the 640K boundary. Should you have time to spare, you can try increasing SMPSIZE again but by a smaller increment.

If, on the other hand, you have 600K or more of free memory when you first run CHKDSK, you can increase SMPSIZE until the amount of free memory begins to drop. Then reduce SMPSIZE to the figure you used just before program memory began to disappear. Again, you can fine-tune by adjusting SMPSIZE in smaller increments.

### SAVING VIDEO MEMORY

The display system you use affects the size of the address range available for keeping PC-MOS code out of the DOS 640K. The operating system maintains a video context switching area that varies in its memory requirement with the display system that you use on the main console. The most frugal, obviously, is monochrome. Graphics systems, including CGA and Hercules, require at least twice as much memory. Thus, if you don't need graphics, IBM's original MDA system will be the most economical you can use.

The VTYPE command you put in your system's CONFIG.SYS file tells PC-MOS the type of display system that you will be using. From the standpoint of optimizing memory usage, the most important VTYPE option available is the F (for Fill) you can append to some of the possible

## FIBER OPTICS ADD COLOR GRAPHICS TO PC-MOS WORKSTATIONS

by Wynn L. Rosch

The one thing that is missing from multiuser PC-MOS systems is color, but soon that deficiency will be remedied by the latest fiber-optic technology. The Software Link is developing new driver software for SunRiver Corp.'s Fiber Optic Station system that will enable multiple users to share a single 80386-based PC and will give each user full-color, bit-mapped graphics with resolutions up to the VGA-plus level. It will also include port support for a mouse and other peripherals. This support will allow users to run a graphics environment such as *Microsoft Windows* at their local terminal.

SunRiver's Fiber Optic Stations look like plain computer terminals and work much the same way. The primary difference is the connection scheme: duplex fiber-optic cable. Once multiuser PC-MOS/386 is up and running on the system, each user sees his own color screen as a window into a PC-MOS session. Ordinary graphics-based DOS applications run on each workstation exactly as they would on a single-user computer. Each workstation operates independently from the rest but shares the PC-MOS file system.

System response is excellent. Thanks to the high-speed, 32-megabit-per-second fiber-optic connection, each workstation achieves almost ex-

actly the same performance as would an independent PC-MOS session on the host computer. Of course, multiple users will drain the resources of even the most powerful computer-server, so the Software Link recommends that current 20- and 25-MHz, 80386 machines be limited to about five users. Tomorrow's 33-MHz computers should be able to adequately support about three more.

SunRiver stations are available for a variety of graphics standards, including Hercules, EGA (up to 640 by 350 pixels), EGA-plus (up to 640 by 480), VGA (640 by 480), and VGA-plus (up to 800 by 600). Each includes a 101-key keyboard that follows the IBM Enhanced style, and each provides two serial and one parallel port. Prices start at \$899 for the Hercules-based monochrome system. Color starts at \$1,799 for EGA-level graphics and rises to \$2,399 for VGA-plus.

If you already have a monitor and keyboard, you can convert them into a Fiber Optic Station by using one of SunRiver's LightPAKs. Packaged into a monitor base that doubles as a tilts-able adapter, the LightPAK includes the necessary fiber-optic adapter electronics, graphics, keyboard, and port hardware for this conversion. LightPAKs are available for Hercules through VGA resolution levels.

Alternatively, any regular PC, XT, or AT computer can also be turned into a Fiber Optic Station by using SunRiver's PC LightCard, which sells for \$799. This expansion board plugs into almost any PC, XT, or AT and offers support for resolutions of up to 640 by 480 pixels. The LightCard-equipped computer can also be used for normal, standalone operations.

Any of the Fiber Optic Stations can be located up to 1,000 feet from the 80386-equipped computer that serves as the host. Up to four can be connected to a single \$699 Server LightCard host adapter, and multiple cards can be installed in a single 80386 system. A Micro Channel architecture version is available for \$899.

In addition to PC-MOS, the SunRiver Fiber Optic Station system also supports Digital Research's *Concurrent DOS 386/Multiuser Graphics Edition*, JGC's *Multiuser VM/386*, Virtual Systems, *Quick Connect*, Unix, and Xenix.

The Software Link should have the necessary driver software available soon; these drivers will be included at no extra charge with multiuser versions of PC-MOS/386.

For more information on Fiber Optic Stations, contact SunRiver Corp., Jackson, Miss.; (800) 635-8069, (601) 957-0100. ■

## Lab Notes

video type identifying numbers you specify. The F option tells *PC-MOS* that it can extend the DOS addressing range above the 640K limit, up to the bottom of display memory. With monochrome systems, this can gain you 64K of additional memory—somewhat more with CGA. Because the EGA and VGA display systems use the addressing range starting at the 640K boundary, however, the F option is unavailable when you use them.

One final memory matter: *PC-MOS* includes its own EMS driver, *SEMS.SYS*, which converts extended memory into expanded memory for programs that require it. Like all EMS drivers, *SEMS.SYS* requires a paging area in the high end of the real-mode memory range. So if you elect to use EMS, all of your applications will probably lose access to 64K of the basic DOS 640K, since *SEMS.SYS* will preclude relocating that much of *PC-MOS*'s code to high memory.

### DISK FORMATTING

When you first make the transition to *PC-MOS*, one of the more-pleasant surprises is that you can simply load it atop your existing DOS directory structure and not even worry about losing any of your existing files. This will hold true if you've been using DOS versions between 3.0 and 3.3, or DOS 4.x if you haven't created volumes greater than 32MB in size. *PC-MOS* uses a directory structure compatible with DOS for partition sizes up to 32MB.

*PC-MOS* lets you venture beyond the bounds of the earlier versions of DOS and split your hard disk into up to four partitions, each of which may be as large as 256MB. However, *PC-MOS* partitions larger than 32MB are not compatible with DOS partitions. Whereas DOS enlarges the file allocation table and provides for 16-bit entries to accommodate bigger volumes, *PC-MOS* simply increases the cluster size instead. For partitions of 32MB or below, *PC-MOS* uses the same 2K clusters as DOS. Between 32 and 64MB, *PC-MOS* uses 4K clusters; for 64 to 128MB, 8K clusters; and for 128 to 256MB 16K clusters.

Unfortunately, larger clusters are not efficient for storing files, particularly small files. To optimize disk usage for very large files (greater than 32MB), you'll want to create two partitions of different sizes us-

ing the *PC-MOS* program *HDSETUP*. Make the first partition, which you'll use for booting the system, 32MB or smaller, and put all your smaller files—programs, batch files, and the like—into it. Then make a larger partition capable of handling your biggest files.

For high-level formatting and partitioning of your hard disk (remember, back up your data first!), it's best simply to use the programs *PC DOS* itself supplies. The Software Link warns that third-party partitioning software (including Storage Dimensions' *SpeedStor*) won't work. One exception to the general prohibition is *Disk Manager* from Ontrack Computer Systems.

The disk-caching program that comes with the operating system will substantial-

ly make the delays, the better your performance will be. *PC-MOS* collects disk writes for the specified delay period you set and actually writes to the disk only at the conclusion of this interval (or when the cache fills). A long delay, however, can leave a substantial amount of data temporarily in RAM, where it is vulnerable to power outages and system crashes. Safety-conscious users may want to opt for read and write delays of zero. On the other hand, if you attach an uninterruptible power supply to your system and stick with proven software, you can stretch the delay to 30 minutes. The default is 10 seconds.

The choice of cache block size is another option that can help you wring a little extra performance from your disk system. If you match the cache block size to the cluster size used by your hard disk, the *PC-MOS* caching program will work more efficiently and faster. With standard 32MB (or smaller) volumes, use a 2K block size.

### PORTS AND TERMINALS

While setting up *PC-MOS* to serve several users, you'll inevitably become intimately acquainted with serial ports. You'll need one port for every terminal you want to connect, so the two or four ports that IBM supports in its PCs and PS/2s may only get you started. In most circumstances, you'll need a multiport adapter that provides four, eight, or more additional serial ports.

Not all multiport adapters are created equal, however. Some are dumb and some are smart. Dumb adapters simply use standard serial port technology—a Universal Asynchronous Receiver/Transmitter chip—and assign different I/O ports to its functions. Examples of this genre are *Port 4* and *Port 8* (\$495 and \$695, respectively, from The Software Link). These ports are called "dumb" because they leave it to your computer's microprocessor to do the brain work of controlling every bit of the data transfer and handshaking. Smart port adapters, like The Software Link's \$695 eight-port *Maxspeed*, have their own built-in microprocessors to handle the data transfer details, taking that load off of your system. Using smart port adapters can improve multiuser system performance by 10 to 20 percent.

The disadvantage to using smart port adapters is that they don't look like ordinary serial ports to your programs. Ordinarily that's not a problem. If you connect a terminal to a smart port, the *PC-MOS* terminal driver takes care of the details. Problems arise, however, when you want to

One of the pleasant  
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ly improve hard disk performance under *PC-MOS*. Most third-party caching programs will also work, though only if you maintain a strictly DOS-compatible file structure. The *PC-MOS* cache, however, knows about its own larger clusters.

When you set up your cache, you're presented with several choices: the amount of extended memory to use, the block size, the read and write delays, and the drives you want to cache. You'll probably want to cache all your hard disk partitions but not your floppy disk partitions. Caching floppies can cause unpredictable slowdowns when the caching program reads from and writes to them, and these delays are more bothersome on a multiuser system than is the normal, predictable floppy operation.

Selecting the read and write delays for the cache is a more vexing job. The longer



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## Lab Notes

connect another kind of serial device—a mouse or a modem, for example—to a smart port. The software that controls the peripheral device expects to see a dumb port and won't know how to deal with its smart cousin. The obvious solution is to use the standard ports in your system (COM1 through COM4) for modem and mouse communication and to add on smart ports only for terminals and printers. (The *PC-MOS* serial printer drivers know how to deal with smart ports.)

What to use for individual workstations is a matter of budget and preference. Your choices include standard ASCII terminals, scan-code terminals (sometimes called PC terminals), and regular PCs running terminal-emulation software. Scan-code terminals—so called because they transfer keystroke information using the same scan codes as PC keyboards—are usually your best choice. They provide full function-key support, can put more than 24 lines on the screen, and impose little price penalty over ASCII terminals.

You'll need to set up the `$$SERIAL.SYS` driver to include the requirements of each terminal you intend to connect to your *PC-MOS* system. Setting up this driver should be easy—you need only specify the communication parameters your terminals use. If your terminals can handle it, set the communication rate at the maximum speed *PC-MOS* supports (38,400 bits per second). Otherwise you should use the fastest speed supported by your terminal.

Including the correct handshaking parameter for the `$$SERIAL.SYS` driver is terminal-dependent and critical. ASCII terminals and terminal emulators work best with `XON/XOFF` handshaking, which is option `/HS=X` on the `$$SERIAL.SYS` driver command line. Scan-code terminals work best with `XPC` handshaking (option `/HS=P`) because the flow-control characters used by the `XON/XOFF` protocol are interpreted by scan-code terminals as alphanumeric characters. PC-based terminal-emulation systems work like ASCII terminals and should use `XON/XOFF` handshaking, not `XPC`. The optional (\$195) *PCEMUlink* terminal emulation program uses its own driver, `ELTERM.SYS`, which is supplied with the emulation software.

If you choose to connect a terminal to

*PC-MOS* through a dial-up modem, be sure to use the `/CN` option when setting up the `$$SERIAL.SYS` driver. Setting `/CN=R` tells *PC-MOS* that your terminal will be using a remote connection and instructs *PC-MOS* to ignore any characters received after the modem that links the console to the terminal loses its data carrier. This prevents spurious characters from polluting a partition.

According to The Software Link, the use of software handshaking (`XON/XOFF` or `XPC`) is preferred for *PC-MOS* over hardware handshaking (`DTR/DSR`). When you choose software handshaking, the hardware wiring for connecting your terminals becomes almost trivial. Only three connections are required: one for data going to the terminal, one for data coming from the terminal, and a common or ground wire. On standard 25-pin serial connectors you use only pins 2, 3, and 7, crossing pins 2 and 3. With cables that have a 9-pin connector on one end and a 25-pin on the other, don't cross wires 2 and 3. If you use two-conductor shielded cable, connect pin 7 to the shield. If your shielded cable has 3 or more conductors, connect the shield to pin 1 on the computer end of the cable.

### BATCH FILES

The inherent complexity of the *PC-MOS* (or any) multiuser system will quickly teach you the value of batch files. The long list of parameters that must be typed in repeatedly makes the use of batch files more a necessity than a convenience.

Even if you use *PC-MOS* simply as an operating environment to provide background processing capabilities for a single user, you'll probably want to set up a batch file for every program that you normally run. The first instruction in the file would be an `ADDTASK` to create a memory partition (which is roughly analogous to a virtual machine or to an `OS/2` session) for the program. You then specify the program to run and conclude the file with `REMTASK` to free up memory for other programs and processes.

*PC-MOS* provides for the creation of start-up batch files that work like `AUTOEXEC.BAT` for each task you start. You simply specify the file to use as part of the `ADDTASK` command. Newcomers to *PC-MOS*, however, sometimes have trouble getting the start-up batch files they've written for some tasks to run. Usually the problem turns out to be that *PC-MOS* can't find the file that it needs. The key thing to

realize is that all start-up batch files indicated by all `ADDTASK` commands must be located in the root directory of the boot hard disk.

In general, *PC-MOS* batch files work like ordinary DOS batch files. *PC-MOS* acts on each line in the batch file as if it had been typed at the computer keyboard. As with earlier versions of DOS, one *PC-MOS* batch file can start another, and when the second finishes, control returns to the first. You can nest and make reiterative loops from batch files to your heart's content.

A few *PC-MOS* batch file commands differ from their same-named DOS coun-

**The inherent complexity of the *PC-MOS* multiuser system will quickly teach you the value of batch files.**

terparts. For example, the `CALL` command in *PC-MOS* calls a named subprocedure within a batch file, while in later versions of DOS, `CALL` executes subordinate batch files.

*PC-MOS* has added some batch file refinements of its own. It gives you several ways to end batch file execution, for example. Execution stops naturally, of course, when the end of the file is reached and no more commands remain. In addition, however, putting a `STOP` command within a batch file (to be exercised by an `IF` condition) will both stop execution and return control to the previous, calling file. The `HALT` command, on the other hand, immediately returns control to the command processor (putting the system prompt on the screen), even if the file containing the command is nested several levels down.

Proper arrangement of subprocedures will result in faster execution of complex batch files. When control returns from another batch file, or when a jump is made within the file, *PC-MOS* starts at the beginning of the file and reads down through it (from disk) until it finds its place again. You can thus speed execution by placing

## Lab Notes

the most-often-read commands near the beginning of a long batch file.

Provisions built into your batch files can protect against hardware conflicts between programs that assume that they are in complete control of given system interrupts. For instance, communication programs assume that they have exclusive access to interrupt 4 when using COM1 and interrupt 3 when using COM2. Many backup programs assume exclusive control of interrupt 6. If two tasks attempt to use the same interrupt, the results are unpredictable and always bad. Consequently, *PC-MOS* provides the *USEIRQ* option to the *MOS* command to reserve specific interrupts for the particular partition in which the command is given. For example, before running a communication program on COM1, you'll want to issue

**MOS USING 4**

To release an interrupt when you're finished with the program that requires it, simply substitute the *FREEIRQ* option for *USEIRQ* in the command above. Note that because *PC-MOS* manages serial printers itself, you don't need to use these commands to prevent conflicts with them.

Batch files also give you the opportunity to control keyboard polling within a *PC-MOS* memory partition. Many programs (*WordStar* is the preeminent example) constantly poll the keyboard for input, and this slows system response. Disabling keyboard polling (with the *MOS DIS* command) when you don't need it will speed up programs such as *Lotus 1-2-3* and *WordPerfect*. You can reenable keyboard polling (the default condition) with the *MOS NODIS* option when you load up *WordStar*.

### MOUSE MATTERS

When running *PC-MOS* in a multiuser configuration, you won't ordinarily need to worry about an infestation of mice. Because most terminals that you might choose are character-based and cannot display all-points-addressable graphics, the issue of using a mouse in conjunction with workstations is moot.

However, when used with special hardware, *PC-MOS* can serve as an excellent foundation for a distributed electronic publishing system or the like. Video Network

Adapters (VNAs) from The Software Link can turn standard monochrome displays and XT keyboards into scan-code terminals with Hercules graphics and full mouse support. A four-user VNA system, which includes a motherboard, three daughterboards, and a translation unit, costs \$2,395. (Still-more-sophisticated display options are discussed in the sidebar "Fiber Optics Add Color Graphics to PC-MOS Workstations.")

Even with *PC-MOS* systems that use standard terminals, you can install either a serial or bus mouse for use at the console. If you do choose to use a mouse, however, don't install its driver through your system's *CONFIG.SYS* file. Use the *.COM* version of the driver instead and load it within the task that will use it. A mouse driver installed through *CONFIG.SYS* will draw upon global memory, potentially stealing RAM from every task or partition you make. Loading the driver from within a task will cut down on memory available to that task. Also, use the *MOS USEIRQ* command to reserve the interrupt used by the mouse for its exclusive use.

### OTHER MATTERS

*PC-MOS* offers several additional refinements over DOS. It contains a command recall buffer, for example. Instead of being limited to recalling only your last command, as DOS is, *PC-MOS* allows you to recall and reuse the last 15 to 20 commands (the exact number depends on their length). The up and down arrows on the cursor pad will move you backward and forward in the buffer, and the left and right arrows allow in-line editing (taking full advantage of the *Ins* and *Del* keys, as well).

The only drawback to the command-recall buffer is that someone may snoop through it should you step away from your PC. Prying eyes may see passwords or the name of the last game you played on company time by recalling them from the buffer. To prevent Big Brother from tuning in during your absence, you can flush the command recall buffer by pressing the *Ctrl-PgDn* key combination at the command level.

The *PC-MOS* editor begins where DOS leaves off. If you just run the program *ED*, you'll get the same familiar asterisk prompt and command-line control structure used by *EDLIN*. But add the */V* option after the filename you specify when entering the editor, and you'll gratefully find that you now have the facilities of a full-screen editor.

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## Lab Notes

An undocumented feature of the PC-MOS DEBUG program will help if you need to troubleshoot your serial ports. After entering DEBUG, if you simply type the command X and press return, DEBUG will display the contents of system memory starting at location 0400:0000, showing you the base addresses of the serial ports installed in your system.

Sometimes the PC-MOS security system can be too secure. The Software Link reports that new users often have difficulty in removing security protection from a file or subdirectory to permit general access. Protection can be easily removed by any user with the proper access to the secured file just by copying the file, using the option /C\_ (the letter C followed by an underscore). The underscore sets the security class assigned to the file to nil.

One way you can take advantage of the multiuser power of PC-MOS is to give a duplicate display to a client or associate. By selecting the same tasks both on the console and one or more terminals, two or more users can simultaneously see the same screen. Using the PC-MOS security options, you can allow users to interact with the screens by typing or lock out the keyboard. You can also lock out other users from seeing your private tasks.

Normally you'll change tasks by pressing Alt and the number corresponding to the task on the numeric keypad. Alternatively, you can use the command SWITCH (which can also be used from within batch files). These two methods of changing tasks differ in a significant way. The keystroke combination affects only the terminal on which it is executed. The SWITCH command belongs to the task in which it is executed. In other words, using SWITCH will cause all workstations currently showing the given task to switch simultaneously to the newly selected task.

### SUMMARY

If you want to learn more about the internal operation of PC-MOS, The Software Link offers a technical reference guide. Unless you're a programmer and want to develop applications for PC-MOS, however, you probably won't want to tangle with it. The technical reference manual consists for the most part of system calls needed for software development.

On the other hand, Martin Stitt, one of

the programmers who helped create PC-MOS, has written a soon-to-be-published book tentatively titled *Inside PC-MOS*. Within it you'll find a wealth of tips for setting up your PC-MOS system and optimizing its operation. A telephone call to The Software Link will give you the most up-to-date information regarding the book's availability.

Though the discussion presented here has centered on The Software Link's PC-

MOS/386, the underlying point is that multiuser systems built around standard PC hardware are emerging as powerful and viable alternatives to LANs and standalone PCs. The small-business user will do well to strongly consider multiuser systems such as PC-MOS/386 as a potential solution to a company's computing needs. ■

Winn L. Rosch is a contributing editor of PC Magazine.



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by  
Bob Flanders and  
Michael Holmes

# Utilities

*Note: This is the first DOS utility presented in this column written in C rather than in assembly language. Broadening our programming-language base to include C and other high-level languages will allow us to present a greater variety of useful utilities and will help readers hone their skills in C (the language that is becoming the de facto standard for writing applications) and other languages. Both source and executable files for the utility can be downloaded from PC MagNet, and the source code will continue to be presented with the article. We regret that the length of most high-level language programs will preclude our printing .BAS listings that could be typed in to create .EXE files. Reader submissions in high-level languages—as well as assembly language—are welcome.—Ed.*

If your programs used to pop up almost instantly but now seem to need a committee decision before loading, chances are they've simply become fragmented. On a frequently used hard disk, parts of a file may end up in widely scattered physical locations. To read them in, the drive head has to waste time jumping back and forth across the disk, reassembling parts that ideally would be stored in a single, contiguous series.

But how often is a frequently used disk accessed? How many files must be fragmented before it's worth getting a defragmenting program, such as one of those we reviewed in the October 11, 1988, issue? Answering that question is the purpose of CHKFRAG, this issue's *PC Magazine* utility.

The easiest way to get a copy of CHKFRAG.EXE is to download it from PC MagNet, as explained in the sidebar "CHKFRAG by Modem." The C source code is listed here and is also available via PC MagNet. If you're working from the source listing, CHKFRAG.C can be compiled with Version 5.0 or later of the Microsoft C Compiler.

After examining how the files are stored on your disk, CHKFRAG presents

**SPEED UP FILE  
LOADING AND  
ACCESS:  
CHKFRAG.EXE tells  
you when it's time to  
defragment the files on  
your hard disk.**

both an on-screen report (making it usable as a standalone utility) and an ERRORLEVEL value that may be used within a batch file to call up your defragmenting program if appropriate. (A suitable batch file prototype is shown in Figure 1.) The command syntax for CHKFRAG is

```
CHKFRAG [d:] [/s] [/n] [/e] [/l]
```

If the *d:* (drive) parameter is omitted, CHKFRAG defaults to analyzing the current drive. As detailed below, the alternative switches */s*, */n*, and */e* tell CHKFRAG the type of DOS return code to set in ERRORLEVEL when returning to DOS. If none is specified, the percentage value is returned. Adding the optional */l* parameter does not change the return code but causes CHKFRAG to print the filenames and directories that are fragmented.

The program's output can be redirected to a file or a printer for easier examination. Although the CHKFRAG.EXE program is only 16K long, you may need more than 100K of available memory in order to run it, depending on the size of the disk you're checking.

The default */s* parameter returns the percentage, from 0 to 100, of fragmented files found. Thus, if you have a disk with

97 files and 3 directories (or 100 total filenames) on the disk, and 2 of the directories and 10 of the files are fragmented, 12 will be returned via ERRORLEVEL. If any files are fragmented, the lowest percentage, 1 percent, will be indicated, regardless of the actual number of files on that disk.

The */n* parameter tells CHKFRAG to return the number of fragmented files. Possible ERRORLEVEL return values range from 0 to 254; the 254 value is used even if more than 254 fragmented files are found. Using the */n* switch is especially suitable for situations in which the number of files on the disk varies widely, so that a percentage may not accurately reflect how much fragmentation exists.

The */e* parameter tells CHKFRAG to return the number of extra segments found. Again, the possible ERRORLEVEL return values are 0 to 254. To be considered fragmented, a file must be split into two or more parts, and each part *after the first* is thought of as an extra segment. If you had two fragmented files, one split into three parts and the other into six, a total of seven extra segments would be reported. The */e* return code is useful when checking a disk with a fixed, relatively small number of files; such a disk should be reorganized (defragmented) when many extra segments develop without regard to percentage or number of files fragmented.

An ERRORLEVEL code of 255 is used to indicate an error condition. The code can indicate that:

- A command-line error was made.
- An invalid drive was specified.
- The DOS ASSIGN or SUBST command defines the drive.
- The drive is a network drive.
- The DOS version is earlier than 2.0.
- There is not enough memory.
- The BOOT record or FAT could not be read.
- There are cross-linked clusters (run CHKDSK).
- There are lost clusters (run CHKDSK).

## Utilities

As suggested by the last two error conditions, before using CHKFRAG you should always check the drive with the DOS CHKDSK utility, specifying the /F parameter. That will salvage what can be saved of cross-linked or lost clusters, a far more serious kind of problem than file fragmentation.

### A DISK OVERVIEW

As indicated at the beginning of this article, fragmentation results whenever the bytes that make up an individual file are not stored in contiguous areas of a disk. This requires the disk heads to move more often than is efficient to read a file. To understand fragmentation more fully, we must first look at how a disk is organized. The sidebar "Directory and FAT Organization: How DOS Keeps Track of the Parts of Your Files" provides a detailed example to supplement the treatment here.

When you issue the DOS DIR command, you see filenames, extensions, file sizes, and date/time stamps. But behind the scenes, more information is being manipulated. Files on-disk are contained in areas known as *sectors*. The usual sector size on a disk is 512 bytes, although a sector can be larger. The sectors on a disk are grouped together in areas known as *clusters*. The number of sectors contained in a cluster is established when the disk is formatted, and the number may vary with the size of the disk and with the disk-formatting software.

In a typical situation, you would have a 20MB drive with 512-byte sectors; the FORMAT program would group four sectors into each cluster, making the size of one cluster 2,048 bytes. If you now save a 2,100-byte file, DOS must store it in two clusters. The first 2,048 bytes of the file fill the first cluster, and the next 52 bytes go into the second. The remaining 1,996 bytes of the second cluster will go unused unless the file owning that cluster grows in length. Any file that is not a "zero-length" file uses a minimum of one cluster.

Immediately following the boot record on the disk is an area known as the FAT (file allocation table). This table keeps track of which clusters are allocated, which are available for assignment, and which (if any) are known "bad spots" that cannot reliably contain data.

The clusters on a disk are numbered sequentially

starting with cluster number 2, and sequentially numbered clusters are physically located next to each other on the disk. As data is written to a file, clusters are allocated to that file. When a cluster is needed during a write operation, the first *available* cluster on the disk is assigned to the file and a notation of the assignment is made in the FAT. The number of the first cluster of a file is stored in the directory entry for that file.

### HOW FRAGMENTATION DEVELOPS

When the cluster numbers assigned to a file are not strictly sequential, the file is considered fragmented. A file that fits entirely into cluster numbers 200, 201, and 202 is unfragmented and will load at optimum speed. If the same file were assigned to cluster numbers 200, 307, and 412, it would be fragmented. A fragmented file loads more slowly because the disk heads must move far more often to read the file, and the movement of disk heads is the slowest part of accessing files.

Generally speaking, fragmentation has a greater effect on processing times of files that are accessed sequentially than those that are accessed randomly, but both types of access work more quickly when the files

involved are not fragmented.

A second, less obvious drawback of fragmentation is that if a file is lost, unearasing (recovering) it is considerably more difficult, if not impossible, because all of the file's clusters are not contiguous. If the clusters are contiguous, unearasing becomes very easy.

### FINDING FRAGMENTATION

There are numerous utilities on the market that will defragment the files on a disk, as indicated in our October 11, 1988, review. At a minimum, each of these utilities will rearrange cluster assignments of files on a disk to make them contiguous. Some will additionally allow you to arrange the actual sequence of files on the disk according to your preference. CHKFRAG's job is to tell you when you would do well to consider using a defragmenter.

An alternative to using a reorganization utility is to back up the disk, reformat it (or at least erase all the files), and then restore your files to the disk. As long as the backup is not an image backup (an actual image of the fragmented disk, created by some tape backup systems), the restore will automatically replace the files in an unfragmented form. Unfortunately, this al-

DEFRAG.BAT	COMPLETE LISTING
<pre>ECHO off CLS ECHO Checking condition of drive %1 ...  chkdsk %1/F &gt;lpt1:  chkfrag %1 /% /L &gt;lpt1: IF ERRORLEVEL 255 GOTO error IF ERRORLEVEL 24 GOTO nodefrag  ECHO Drive %1 fragmented 25% or more .. starting defrag defragit %1&gt;lpt1      *** Replace with your utility *** GOTO end  :nodefrag ECHO Drive %1 does not require defragging GOTO end  :error ECHO Error occurred during CHKFRAG.  :end ECHO DEFRAG done.</pre>	

Figure 1: This is a prototype of a batch file that runs CHKDSK and CHKFRAG on a designated drive. If 25 percent or more of the files on the drive are fragmented, the defragit command (which you would replace with the proper command for the defragmenting utility you have on your system) will be executed. Note: The defragmenter you use may not support redirection of its output to a printer, assumed here to be connected to LPT1:.

ternative method is usually time consuming and tedious if there is a significant amount of data to be backed up and restored.

## HOW CHKERAG WORKS

At startup, CHKFRAG first checks the command-line parameters and prints an error message if there is an obvious mistake. A test is then made to assure that the disk requested is a valid drive, is not a network drive, and is a separate disk volume (as opposed to being a SUBSTituted or AS-

SIGNED volume). This is done with DOS function 44h (IOCTL) and the undocumented DOS function 60h. For want of a better name, we call this function Translate DOS Name; it will be discussed more fully below.

If the disk checks out all right, the FAT must then be read into memory. In order to

## CHKFRAG.C

1 of 4

```

*****
*      chkfrag - check disk for fragmentation
*
*****
#include <stdio.h> /* standard library */
#include <char.h> /* for char access and registers */
#include <malloc.h> /* memory allocation */
#include <stdlib.h> /* common lib modules */

#define UIMT unsigned int
#define HLOW unsigned long
#define HOP 1
#define HOP2 2
#define HOP3 3
#define HOP4 4
#define HOP5 5
#define HOP6 6
#define HOP7 7
#define HOP8 8
#define HOP9 9
#define HOP10 10
#define HOP11 11
#define HOP12 12
#define HOP13 13
#define HOP14 14
#define HOP15 15
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#define HOP382 382
#define HOP383 383
#define HOP384 384
#define
```

[illegible]





```

if ((dta.dta_d_attrib & _A_SUBDIR)) /* q. directory? */
{
    if (dta.dta_filename[0] == '.') /* .. or a dot dir? */
        continue; /* a. get next entry */

    dir++ /* accumulate dir count */
    dir_search(work_dir); /* recursively call ourself */
}
else /* first pass processing */
{
    if (rc) /* q. anything found? */
    {
        if (first_done == 0) /* a. no .. */
            rc = execute(find-first); /* re-execute find-first */
        pass++; /* go to next pass */
        continue; /* .. continue processing */
    }

    if (dta.dta_filename[0] == '.') /* q. dot directory? */
        continue; /* a. yes .. skip it */

    if ((dta.dta_d_attrib & _A_SUBDIR)) /* q. a file? */
        file++; /* a. yes .. count them */

    check_frag(work_dir, /* check for frag'd file */
               dta.dta_d_cluster,
               dta.dta_d_attrib & _A_SUBDIR);
}

r.h.sh = $uic; /* sh = set DTA */
s.da = cldis; /* da -> DTA segment */
r.x.da = cldis; /* da -> DTA */
int$6($x2l, sr, sr, sr); /* setup new DTA */
}

/*****
 *
 * fname -- build a normalised filename from a PCN
 *
 *****/
char *fname(filename, ext) /* filename with trailing blanks */
char *filename; /* extension */
{
    int i; /* loop control */
    char *p; /* work pointer */
    static char work(13); /* returned work area */

    p = fwork; /* initialize string pointer */
    for (i = 0; (i < 8) && (filename[i] != ' '); i++) /* move fname w/o blanks */
        *p++ = filename[i];

    if (*ext != '\0') /* q. extension blank? */
    {
        *p++ = '.'; /* a. no .. add the dot */
        for (i = 0; (i < 3) && (*ext[i] != ' '); i++) /* add ext w/o blanks */
            *p++ = ext[i];
    }

    *p = 0; /* terminate string w/null */
    return(fwork); /* return string to caller */
}

/*****
 *
 * strclr -- clear an area to a value
 *
 *****/
void strclr(a, c, n) /* area to initialize */
char *a; /* value to use */
int c, n; /* length of area to clear */
{
    while(n--) /* initialize whole area */
        *a++ = c; /* .. to value specified */
}

/*****
 *
 * translate_name -- translate a DOS name
 *
 *****/
char *translate_name(name) /* name to translate */
char *name;
{
    static char translate_area[65]; /* work/return area */
    int i; /* work pointer */
    union REGS r; /* work registers */
    struct SREGS s; /* .. and work segment regs */

    r.h.sh = $uic; /* sh = translate */
    sp = (char far *) name; /* set up a pointer .. */
    r.x.ax = 77; /* set pointer to input name */
    s.es = 77; /* .. and segment */
    int$6($x2l, sr, sr, sr); /* translate the name */

    if (r.x.cflag) /* if bad name .. */
        return((char far *) NULL); /* .. return error */

    else
        return(translate_area); /* return listed name */
}

/*****
 *
 * chdrv -- assure drive is LOCAL and not SUBST'd or ASSIGN'd
 *
 *****/
int chdrv(c) /* drive to check */
char c;
{
    union REGS r; /* work registers */
    struct SREGS s; /* .. and work segment regs */

    static char wdrv(8) = " \\"; /* work area for drive name */

    if (_osmajor < 2) /* q. pre-DOS 3.86? */
        return(4); /* a. yes .. can't run it */

    if (_osmajor >= 3 && _osminor >= 1) /* q. DOS 3.1 or higher? */
    {
        r.x.ax = $uic; /* sh = local, local test */
        r.h.bl = (c - 'A') + 1; /* bl = drive to test */
        int$6($x2l, sr, sr); /* test drive */

        if (r.x.cflag) /* q. bad drive? */
            return(1); /* a. yes .. error */

        if (r.x.dx & $uic) /* q. remote? */
            return(2); /* a. yes .. error */

        wdrv[0] = c; /* set up name */

        if (strcmp(wdrv, translate_name(wdrv))) /* q. SUBST or ASSIGN'd? */
            return(3); /* a. yes .. return error */
    }

    return(0); /* return ok */
}

/*****
 *
 * read_drive_label, if available
 *
 *****/
char *read_label(c) /* drive to check */
char c;
{
    char *p; /* work pointers */
    struct find_f; /* structure for directory entry */

    static char work_dir(13) = " \\"; /* directory to check */

    work_dir[0] = c; /* setup for find first */

    if (_dos_findfirst(work_dir, LABEL, sf)) /* q. error on label get? */
        work_dir[0] = 0; /* a. yes .. then no label */

    else
    {
        for(p = work_dir, q = f.name; *q; q++) /* copy label w/o middle */
            if (*q != '.') /* q. is this char a dot? */
                *p++ = *q; /* a. no .. copy it */

        *p = 0; /* terminate string */
    }

    return(work_dir); /* .. and return label string */
}

/*****
 *
 * cfmatt() - return to DOS after resetting dir, dir
 *
 *****/
void cfmatt(rc) /* return code to exit with */
int rc;
{
    int i; /* work variable */

    _dos_setdrive("drive - 'A'+1, 4); /* reset the default drive */
    chdir(cdrv); /* .. and directory */
    exit(rc); /* .. and return to DOS */
}

```



## Utilities

### CHKFRAG BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

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Bob Flanders and Michael Holmes

## CHKFRAG Command

August 1989 (Utilities)

### Purpose:

Reports on-screen the extent of file fragmentation on a hard disk and provides an ERRORLEVEL value usable within a batch file to call a defragmenting program.

### Format:

CHKFRAG [*d:*] [/N | /N1] [/E] [/L]

### Remarks:

Executed without any of its optional parameters, CHKFRAG produces a screen report indicating the number of files and directories on a disk, how many and what percentage of these are fragmented, and how many extra (noncontiguously stored) parts of files are contained on the currently logged drive. An ERRORLEVEL code of 0 to 100, reflecting the percentage of fragmented files (the /% parameter is the default), is also shown.

An alternative drive (*d:*) to be analyzed may be specified, as may ERRORLEVEL return codes that reflect the actual number of fragmented files (the /N parameter) or of extra sections (the /E parameter). The ERRORLEVEL return codes are not intended for strict accuracy: if any file is fragmented, the minimum ERRORLEVEL returned by the /% parameter is 1 percent, and 254 is the maximum ERRORLEVEL returned by the /N and /E switch options. These return codes are intended to be used to trigger automatic loading and execution of the user's defragmenting utility from within a batch file. An ERRORLEVEL return code of 255 is used to indicate an error condition, which halts operation.

If desired, a list of the names of fragmented files and directories can be produced by specifying the optional /L parameter. The normal screen output from CHKFRAG may be redirected to a file or printer for easier analysis.

The DOS CHKDSK command, specified with its /F switch, should be executed before running CHKFRAG; lost clusters or cross-linked files are interpreted by CHKFRAG as error conditions. Drives created with the DOS ASSIGN or SUBST command and directories created by JOIN are not checked by CHKFRAG. While analyzing large disks, the utility requires approximately 100K of available RAM. CHKFRAG's on-screen recommendations are to consider using a defragmenting utility when file fragmentation is between 11 and 75 percent and definitely to use one with 75 percent or greater fragmentation.

CHKFRAG.EXE was written in the C language, and its source code should be compiled using Version 5.0 or later of the Microsoft C compiler.

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## Utilities

read the FAT, the number of sectors in the FAT must be known. That number is contained in the boot record (sector 0) of the disk. In order to read the boot record, the sector size of the disk being tested must be known so that enough space for the sector and the FAT can be allocated.

Getting the sector size is a fairly simple operation. One of the parameters returned by DOS function 36h (Get Disk Free-space) is the sector size. This value is used to allocate memory into which a sector (in this case, the boot record) can be read.

The boot record contains the number of sectors in the FAT. From this information the size of the FAT is calculated, an appropriate number of bytes is allocated, and the FAT is read in. Note in the code that the allocation for the FAT is done via a huge allocation call. This allows CHKFRAG to work with a FAT longer than 64KB; such lengths are often encountered when dealing with disk volumes that exceed the old 32MB DOS "barrier."

Starting with the root directory, CHKFRAG then analyzes the cluster allocations for all files and subdirectories to see whether the segments for each are contiguous. If the segments of a file or subdirectory are not contiguous, the appropriate counters are incremented and, if the /L parameter was specified on the command line, the filename or directory name is displayed. When all files and directories have been checked, the appropriate count or percentage is returned as a DOS return code.

### UNUSUAL ALGORITHMS

While all of this sounds straightforward, there are a few unusual turns that CHKFRAG must take while it is analyzing the disk. Mention was made earlier of the undocumented DOS function 60h, which we called the Translate DOS Name function. This function takes a pointer to an ASCIIZ "name" of an object (pointed to by DS:SI) and translates it into a ASCIIZ string (pointed to by ES:DI) that fully represents the location of that object. For example, if you pass the string \ to the translate function, the return message will be x:\ where x is the letter designation of the current drive. In the same way, if you give this function the name of a SUBstituted or ASSIGNed drive, the return will be the actual name of the drive. If the name returned

is not the same as the name passed, the reason is generally that that drive is the result of a DOS ASSIGN or SUBST command. Such drives cannot be checked with this utility. The same call works with redirected network devices on the IBM Token-Ring Network. Unfortunately, since function 60h is undocumented, the call may not be maintained in future versions of DOS.

Another unusual (though in this case documented) function used by CHKFRAG is DOS function 44h, IOCTL. This is used to check if a disk is a local or remote (that is, network) drive. CHKFRAG will only check a drive that DOS thinks is locally attached to your machine. Note that it is up to the device driver for the disk being

**One of the most-  
interesting routines  
to implement is a  
recursive routine—  
a routine that calls  
itself.**

checked to tell DOS whether the device is local or remote.

Perhaps the most confusing function we had to implement in CHKFRAG is one that traces chains of clusters in the FAT. (For a more general discussion of the relation between the FAT entries and cluster numbers, see the sidebar "Directory and FAT Organization.") Based on the size of the disk, the FAT can consist of a series of 12-bit or 16-bit entries. Each entry represents a particular cluster and contains a pointer to the next cluster for that file or subdirectory.

When the FAT consists of 16-bit entries, the code to read it is very straightforward, because the FAT is essentially an array of integers. But when the FAT consists of 12-bit entries, it becomes somewhat more challenging. At 12 bits per entry, each entry occupies 1.5 bytes. In order to get the entry, you load the value into a 16-bit work variable and keep the upper 12 or the lower 12 bits, depending on whether the cluster number is odd or even. Although the code to do this is fairly simple, debugging can be a bear. That's because

the bytes in memory are reversed, thanks to the way the CPU stores word values in memory. If you're looking at a register display after a FAT entry has been loaded, the value looks very logical. But if you look at the FAT in memory, you must cross your eyes and go blind in the right half of your left eye or the left half of your right eye, depending on whether the cluster number is odd or even!

### RECURSIVE ROUTINES

One of the most-interesting types of routines to implement is a recursive routine—a routine that calls itself. It's not often that you need recursion to implement an algorithm, but a directory search is one instance when it fits perfectly. The directory search is the heart of CHKFRAG.

The directory search routine is called with the name of the subdirectory that is to be searched. The routine checks each of the files and subdirectory entries in the directory passed, checking the FAT chain of each for fragmentation. After this, the routine calls itself with the name of each directory encountered in the current search. This continues until every directory has been searched.

When CHKFRAG starts, the first call to the directory search routine passes the root directory of the disk to be checked. The directory search routine takes it from there, testing every file and subdirectory on the disk. Note, however, that if a "directory" represents a disk integrated into the current file system by a DOS JOIN command, that subdirectory will not be checked.

Finally, a couple of notes are in order about the nuances of various DOS calls. The first concerns the Find First and Find Next calls. In looking at the code, you may have wondered why we didn't use the `_dos_findfirst()` and `_dos_findnext()` routines instead of the old-style FCB (File Control Block) calls. In fact, the original code for CHKFRAG did—until we discovered that the new-style DOS calls don't contain the first cluster number anywhere in the returned information! The old FCB calls return the actual directory entry, which does contain the cluster number. Without these "outmoded" calls, CHKFRAG would have to calculate and read the absolute sectors of directories in order to get the entries and the cluster numbers in them.

The other note concerns the DOS Read Volume Label code. This routine consists of issuing a `_dos_findfirst()` with the



## DIRECTORY AND FAT ORGANIZATION: HOW DOS KEEPS TRACK OF THE PARTS OF YOUR FILES

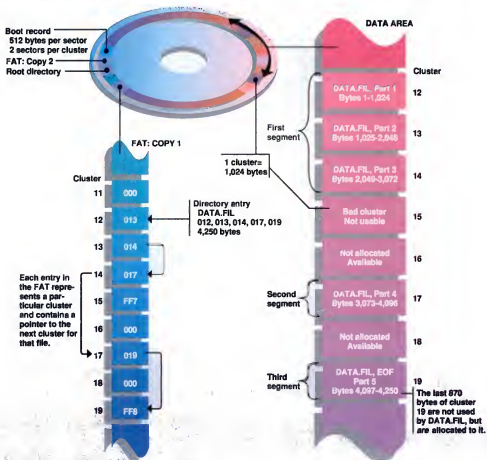
This diagram depicts how DOS stores and links data on a disk. A disk contains four basic areas: the boot record, the file allocation table (FAT; two copies), the root directory, and the data area. Both copies of the FAT contain the same information.

DOS stores data on a disk in areas called sectors, which are grouped together to form clusters. When the disk is formatted, the size of its leading off sectors and clusters is determined by the size of the

disk and by the formatting software. DOS stores this information in the *boot record*. In this diagram, the boot record shows 512 bytes per sector and 2 sectors per cluster, indicating a cluster size for the disk of 1,024 bytes.

DOS reserves the following clusters:  
0—unallocated cluster  
1—invalid cluster number  
FF0–FF6—reserved clusters  
FF7—bad cluster  
FF8–FFF—last clusters in chain (EOF)

The *file allocation table* is an array of integer values that indicates the order in which clusters were allocated to store files on the disk. A directory entry is made in the FAT for every file or subdirectory in the data area. This entry includes the filename, its length in bytes, and the numbers of the clusters it occupies. If the cluster numbers assigned to this file are not sequential, the file is considered fragmented.



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## Utilities

argument indicating the root directory and the attributes indicating the disk label. You would suppose that if you passed it the label attribute, DOS would know to look in the root directory, since that's the only place a label entry can exist. But DOS requires the wildcard `x:\*.*` to find the label, `x` being the drive to check.

### RECOMMENDATIONS

We designed CHKFRAG to operate principally within a batch file. However, the program does produce an on-screen report

**CHKFRAG produces  
an on-screen report  
that will interest  
anyone using it as a  
standalone utility.**

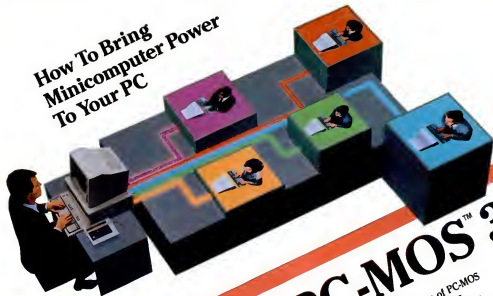
that will interest those of you who want to use it as a standalone utility. The last line of the report is a suggested course of action.

Regardless of the type of fragmentation `ERRORLEVEL` selected, the suggestion is based on the percentage of fragmented files. If no fragmentation is found, the obvious "No fragmentation—No action suggested" is displayed. For 1 to 10 percent fragmentation, the report is "Little fragmentation—No action suggested." If there is 11 to 75 percent fragmentation, "Moderate fragmentation—Defrag should be performed soon" is displayed, and for 76 to 100 percent, "Fragmentation critical—Defrag or Backup/Format/Restore."

These suggestions should not be construed as absolute pronouncements, but rather as our recommendations of reasonable courses of action when you ask CHKFRAG to tell you the condition of the files on your hard disk. ■

*Bob Flanders is president and senior systems analyst and Michael Holmes is vice president and senior systems analyst at NCI Systems, in Annandale, Virginia.*

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by  
Charles Petzold

# Environments

What's involved in converting a DOS program to the OS/2 Presentation Manager? Unfortunately, as we shall see, there isn't a single, simple answer to this question.

Presentation Manager facilities primarily involve the user interface components of the program—menus and dialog boxes, keyboard and mouse input, and the display of text and graphics on the screen. Thus, much of the nonprogramming work involved in infusing your program with the look and feel of the Presentation Manager will probably involve an extensive redesign of the program's user interface.

For large applications, the conversion job will be easier if the DOS program has a clean separation between the user interface parts and the internal "engine" functions.

Very small programs, such as the utilities presented in the Productivity section of *PC Magazine*, often require a complete rewrite. These programs usually make extensive use of DOS function calls, BIOS keyboard functions, and direct screen writes. Quite often, as I've discovered, small programs have almost no code that can be salvaged for a Presentation Manager conversion.

To illustrate what's involved, this column and my next Environments column present a Presentation Manager version of a DOS program that appeared in *PC Magazine's* March 10, 1987, issue's Utilities column. Written by Jeff Prosis, ASC.COM is a RAM-resident DOS pop-up. When you invoke the program it creates a small window on the screen and displays an ASCII table, as shown in Figure 1. You can scroll through the table using the cursor movement keys.

## CONVERTING ASC TO PMASC

The Presentation Manager version of this program is called PMASC. Interestingly enough, as you can see in Figure 2, I was able to preserve much of the look and feel of ASC in PMASC. The two programs not only look a lot alike, they function similarly, too. Both programs respond to the Home, End, PgUp, PgDn, and Up- and

**Reworking one of our popular utilities will give you a taste of what's involved in converting RAM-resident DOS programs to the Presentation Manager.**

Down Arrow keys to scroll through the table. In addition, PMASC has a Scrollbar that lets you scroll through the table using the mouse.

In this respect, then, I lucked out. I didn't have to do any real look-and-feel design. Jeff Prosis had already done that, and what he did worked very well in the Presentation Manager version.

But I was not so lucky with the code in ASC. Because ASC is a RAM-resident

pop-up utility, some of the program is devoted to making the program resident, intercepting keystrokes, and popping up the program on the screen. Under the Presentation Manager, every program is a pop-up, so all this logic is irrelevant and must be replaced with the normal window-creation functions used by PM programs.

After popping up, ASC used the BIOS interrupt 16h to read keystrokes and it wrote character-mode output directly to the video display. The Presentation Manager way of doing these things is very different. A PM program gets keystrokes in the form of messages and writes to the screen using GPI (Graphics Programming Interface) functions.

So it didn't take me long to realize that none of the code in ASC would find its way into PMASC. Of course, ASC was written in assembly language and I was planning to write PMASC in C, so that was another inducement to do a complete rewrite.

ASC.ASM was about 680 lines of tightly coded assembly language. PMASC.C is about 320 lines of C code. As with most other Presentation Manager programs, a few other short files (including a resource script and a module-definition file) are also required. The ASC

Figure 1: This is how Jeff Prosis's ASC.COM program looks when popped up under DOS.

Dec	Hex	Char	Dec	Hex	Char
0	0		16	10	P
1	1	!	17	11	Q
2	2	@	18	12	R
3	3	A	19	13	S
4	4	B	20	14	T
5	5	C	21	15	U
6	6	D	22	16	V
7	7	E	23	17	W
8	8	F	24	18	X
9	9	G	25	19	Y
10	A	H	26	1A	Z
11	B	I	27	1B	[
12	C	J	28	1C	\
13	D	K	29	1D	]
14	E	L	30	1E	^
15	F	M	31	1F	_
16	10	P	32	20	`
17	11	Q	33	21	a
18	12	R	34	22	b
19	13	S	35	23	c
20	14	T	36	24	d
21	15	U	37	25	e
22	16	V	38	26	f
23	17	W	39	27	g
24	18	X	40	28	h
25	19	Y	41	29	i
26	1A	Z	42	2A	j
27	1B	[	43	2B	k
28	1C	\	44	2C	l
29	1D	]	45	2D	m
30	1E	^	46	2E	n
31	1F	_	47	2F	o

## Environments

.COM file is about 1,170 bytes; PMASC.EXE is about 6,250 bytes. PMASC's code segment occupies about 3,200 bytes in the .EXE file, so this is a reasonable differential for small programs converted

is and how the Presentation Manager graphics interface handles codepages.

### THE PM CODEPAGES

The purpose of PMASC is to display an ASCII table. But under the Presentation Manager this is not as simple as it sounds. In particular, which ASCII table should PMASC display?

ASCII stands for American Standard Code for Information Interchange, and it was crowned as a standard by the American National Standards Institute (ANSI) in 1977. It has become a standard for virtually all personal computers and for many minicomputers, as well. In ASCII, a 7-bit code represents letters, numbers, and a collection of common symbols. Displayable characters are defined for codes 32 through 126. Codes 0 through 31 and code 127 are control codes.

While the ASCII character set is fine for the bulk of text information in English, it does not include any letters with accent (or diacritic) marks commonly used in many European languages. However, many computers use an 8-bit byte for storing text strings, so it's possible for additional letters and symbols to be defined for codes from 128 through 255.

Over the years, then, these 128 additional codes have been used for characters not in the normal ASCII character set. The only problem is that it's been done in several different ways. When IBM developed the PC, it used the codes above 127 for a set of accented letters, a Greek alphabet, mathematical symbols, and line-drawing characters. The PC character set with which we are familiar is hard-coded into the ROMs of many video display adapters and printers, and it has been reproduced in

countless books and articles.

The IBM PC character set includes some accented letters; however, it does not include enough of them for many European languages. For this reason, several European countries use the codes above 127 for their own text needs.

Beginning with DOS 3.3, IBM attempted to bring some order to this by introducing the concept of the codepage. A codepage is simply a mapping of numbered codes (generally 0 through 255) into symbols (or "glyphs") that include the alphabet, numbers, punctuation, and other handy symbols.

DOS 3.3 supports five such codepages. Each has a three-digit identification number. Codepage 437 is the standard IBM character set; codepage 850 is a general-purpose multilingual set. In codepage 850, many of the line-drawing characters (spe-

**The purpose of PMASC is to display an ASCII table. But under the Presentation Manager this is not as simple as it sounds. In particular, which ASCII table should PMASC display?**

from assembly language to C.

Of course, I couldn't resist adding some new features to the program. In addition to the Scrollbar, which adds a mouse interface to the program, a second new feature you can see in Figure 2 is a menu option labeled Codepage. Let's stop our discussion for a moment to examine what a codepage

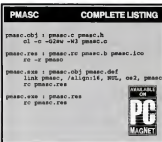


Figure 3: With the IBM or Microsoft C compiler and OS/2 1.1, the PMASC Make file correlates the related files to produce PMASC.EXE.

cifically those that use both single lines and double lines) are replaced with accented letters. Codepages 860, 863, and 865 are character sets for Portuguese, French Canadian, and Norwegian, respectively. In all these codepages, the codes from 0 through 127 map to the same characters. But certain codes between 128 and 255 map to different characters, depending on the codepage.

The use of different codepages on character-mode video displays became feasible under DOS only with the introduction of the EGA. That's because the EGA allows software to replace the default character set with a new one. This could not be done in character-mode on the CGA because the character set was hard-coded in ROM.

In OS/2, as in DOS, codepage 437 (the original PC character set) is the default for character-mode programs. This default can be changed using the CODEPAGE

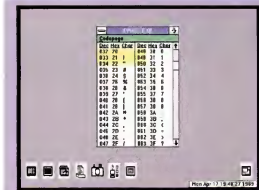


Figure 2: PMASC, running under the OS/2 Presentation Manager, presents many visual similarities to the original ASC.COM.

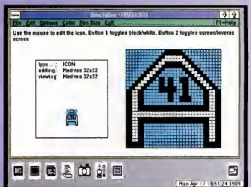
## Environments

statement in CONFIG.SYS and the CHCP command, just as in DOS. Of course, hardware support is necessary for OS/2 to use different codepages in character mode.

The OS/2 Presentation Manager runs in a graphics mode. A graphics system doesn't rely on ROMs on the video board for displaying text. Instead, the Presentation Manager handles the display of text through software, using font files. If the Presentation Manager font files support multiple codepages, implementing them from software should be trivial.

And indeed, that is the case. You may be surprised initially to learn that codepage 437 is not the default codepage for Presentation Manager programs. But why should it be? The line-drawing characters are simply not needed in a graphical environment,

Figure 5: The PMASC.ICO icon as displayed by ICONEDIT. This binary file can be downloaded from PC MagNet.



because programs can just draw lines wherever they want. It makes a lot more sense to use codepage 850 (the general-purpose multilingual set) as the default.

That is exactly what IBM has done.

The Presentation Manager still supports codepage 437, of course, as well as the other three codepages (860, 863, and 865) mentioned earlier. Any of these codepages can be selected by a program that uses the PM's GPI for displaying text on the screen. A PM program can obtain the current codepage identifier by calling the GpiQueryCp function, and it can switch to a different codepage by using GpiSetCp.

For example, if a Presentation Manager program really wants to use codepage 437, all it needs to do is call

```
GpiSetCp(hps, 437);
```

The hps parameter is a handle to a presentation space. This function changes the codepage only for this particular presentation space; it doesn't affect any other presentation spaces that may have been created in this system.

### AND EBCDIC TOO!

While ASCII dominates the world of personal computers, IBM mainframes and minicomputers don't use it. They use a system called EBCDIC (Extended Binary Coded Decimal Interchange Code), instead. EBCDIC was originally derived from the codes used on punched cards, and it is quite different from ASCII. For example, ASCII codes 41h through 5Ah map to the uppercase letters A through Z. In EBCDIC, codes C1h through C9h are A through I, D1h through D9h are J through R, and E2h through E9h are S through Z.

Of course, just as it's fairly easy for a graphics system to support multiple ASCII codepages, it should be easy to support EBCDIC codepages as well. This is partic-



Figure 4: PMASC.RC contains or references all of the resources used to make PMASC.EXE.

## Environments

ularly important to IBM because of the links the company is building between personal computers and its larger machines. For example, a PC program receiving text data through GPI's normal text output functions without any internal conversion. The Presentation Manager supports no fewer than 11 EBCDIC codepages in addition to the 5 ASCII codepages.

You can use PMASC to view any of these 16 codepages. They are all listed as options in PMASC's menu. So, PMASC is more than just an ASCII table—it's an EBCDIC table as well. If you'd like to compare these codepages on the screen, you can run multiple versions of PMASC and view them side by side.

### THE 315 CHARACTERS

Exactly how does the Presentation Manager program support 16 codepages? Does it mean that there must be 16 different versions of each font file?

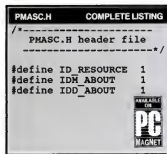


Figure 6: The PMASC.H header file is used in constructing the executable.

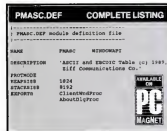


Figure 7: This is the module-definition file used in creating PMASC.EXE.

In fact, it doesn't mean that at all. It turns out that all of the codepages share a great many characters. The total number of characters in every one of the codepages is 315. Therefore, each font that is included in the retail release of OS/2's Version 1.1 contains exactly 315 characters. The first 256 characters are the characters that are

contained in codepage 850.

Whenever the user (or a Presentation Manager program) selects a codepage that is different from codepage 850, all that the Graphical Programming Interface has to do is set up a new table in order to map the codes 0 through 255 to a subset of these original 315 characters.

Figure 8: The arrows next to the ASCII and EBCDIC items on the main PMASC submenu indicate that additional submenus are available.



Figure 9: Selecting the ASCII item from the main menu permits the further selection of any of the five available codepages.

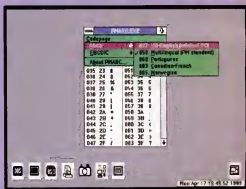


Figure 10: Similarly, the EBCDIC submenu lists the 16 EBCDIC codepages available for display.





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## Environments

### THE PMASC FILES

Now let's start looking at the source code files that are used to build PMASC.EXE. Six files are required. You can download all of these files—as well as the PMASC.EXE executable—from PC MagNet. I will show you five of these files in this col-

umn and will save the PMASC.C for discussion next time.

PMASC (with no extension) is a Make file and is shown in Figure 3. Assuming you have the six source code files, and have installed the IBM or Microsoft C compiler and OS/2 1.1 Programmer's Toolkit, you can create PMASC.EXE simply by executing

MAKE PMASC

PMASC.RC, shown in Figure 4, is a resource script file. I'll describe this file in more detail shortly. PMASC.ICO is a binary icon file referenced in PMASC.RC. Figure 5 shows a view of this icon as displayed by the ICONEDIT program. The icon is a capital A (which stands for ASCII) with a little "41," the hexadecimal ASCII code for this character.

PMASC.H (see Figure 6) is a header file that contains definitions of three identifiers used in both the PMASC.RC and PMASC.C files. Finally, PMASC.DEF, listed in Figure 7, is the module-definition file that LINK uses when constructing PMASC.EXE.

### THE MENU TEMPLATE

The PMASC.RC resource script contains (or references) all of PMASC's resources: an icon (stored in PMASC.ICO), a menu template, and a dialog box template.

When using PMASC, you select the codepage you want to view from the menu. The menu template in PMASC.RC contains all the items in PMASC's menu and shows how the items are nested. The main menu bar contains one item—the word Codepage. The keyword SUB-MENU indicates that this item invokes a drop-down submenu, which is shown in Figure 8.

The submenu has three items: ASCII, EBCDIC, and About PMASC. The About PMASC item causes the program to display a dialog box, the template of which is also in PMASC.RC.

You'll notice in Figure 8 that the ASCII and EBCDIC selections have small triangular arrows to right of the text. The triangles mean that these items invoke additional submenus showing the available codepages. Figure 9 shows the submenu that lists the ASCII codepages, and Figure 10 shows the EBCDIC submenu.

The ability to nest submenus in this way goes a step beyond the menu logic in *Microsoft Windows*. In *Windows*, it is not possible to nest submenus beyond drop-down menus invoked from the items on the main menu bar.

Each item in the menu template in PMASC.RC has a number associated with it, listed at the far right. This is the number that the menu window uses when sending the client window a WM\_COMMAND message to identify which item has been selected. I used the actual codepage number for these identification numbers. In the next issue we'll see how this simplifies the menu processing in PMASC.C. ■

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by  
Ray Duncan

# Power Programming

My recent columns have dealt with the management of two of the three kinds of RAM found on PCs: conventional memory, which lies below the 640K boundary and is under the control of MS-DOS, and extended memory, which lies above the 1MB boundary. To round out this series properly, I must pay at least some attention to expanded memory management as well.

Expanded memory is a topic that has been addressed repeatedly for the last year or two in MS-DOS books and magazines. A recent issue of the now-defunct *PC Tech Journal* even had an extensive discussion of using expanded memory in FORTRAN programs! Still, in these days of gargantuan application programs written in high-level languages, proliferating TSRs, bulky network software, and increasingly pudgy versions of MS-DOS, expanded memory management *must* be in every competent DOS programmer's bag of tricks, so I feel justified in covering the same old ground one more time.

## THE EXPANDED MEMORY SAGA

Expanded memory is basically bank-switched memory—fast storage that can be larger than the CPU's normal address space. Expanded memory is subdivided into smaller chunks (called *pages*) that can be independently mapped in or out of the CPU's address space on demand, as illustrated in Figure 1.

The concept of bank switching is hardly new. It was used extensively on Apple II and S-100 bus computers to overcome the 64K address limitations of their CPUs. In the earliest days of the IBM PC, bank-switched memory boards called JRAMs were sold in truckloads by a company called Tall Tree Systems. But the type of bank-switched memory known as expanded memory has been enormously successful because its proponents defined it as a software interface rather than in terms of hardware.

The origins of the Lotus/Intel/Microsoft Expanded Memory Specification (EMS) have already become the subject of

Here's how to design  
your programs so that  
they can detect and  
take advantage of any  
installed EMS memory.

apocrypha. The first EMS, developed jointly by Intel and Lotus, was announced and distributed to software developers at the 1985 Spring Comdex in Atlanta. For some reason this document was numbered as Version 3.0. Microsoft, which was looking for a way to satiate *Windows'* notorious appetite for memory, quickly bought into the EMS concept. After some minor changes, a new specification—Version 3.2—was released in September of the same year as a joint effort of Intel, Lotus, and Microsoft.

However, EMS didn't become an in-

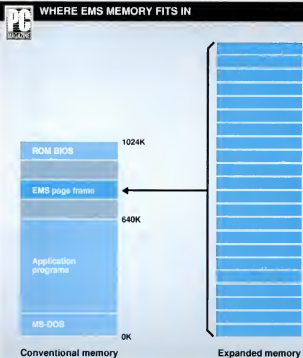


Figure 1: In EMS, Versions 3.0 and 3.2, expanded memory pages are mapped into an area above the 640K boundary, called the *page frame*. In Version 4.0, pages may be mapped anywhere in memory.

## Power Programming

dustry standard without a few squeaks of dissent. The ink was hardly dry on the EMS blueprints before some of the LIM axis's competitors proposed an alternative standard, which they called the AST/Quadram/Ashton-Tate Enhanced Expanded Memory Specification (AQAEEMS). The EEMS was immediately endorsed by Digital Research, which in those days still fancied itself the arch rival of Microsoft. Fortunately for the sanity of software and memory board designers everywhere, the good sense of the marketplace prevailed. After serving as article fodder for *InfoWorld* and *PC Week*, the AQAEEMS faded quickly into obscurity.

EMS, Version 3.2, was completely stable for about 2 years, during which it gained remarkably broad support among both software and hardware manufacturers. At the end of that period, you'd have been hard pressed to find a conventional or extended memory board that could not also be configured as expanded memory. Similarly, the ability to exploit expanded memory showed up in every class of software, from spreadsheet programs to network drivers to pop-up notepads. And, of course, expanded memory was the natural ally of every vendor of a RAMdisk, disk cache, or print spooler.

The programmers responsible for maintenance of MS-DOS itself, on the other hand, have been much slower to take advantage of expanded memory. MS-DOS 4.0 was the first version that so much as recognized expanded memory's existence, and DOS 4.0 uses EMS memory only for certain private tables and buffers.

In October 1987, Lotus, Intel, and Microsoft released EMS. Version 4.0. It

```

TESTING FOR EMS (I)                                     COMPLETE LISTING

emname db      'EMXXXXX',8      ; guaranteed device name for
                                ; Expanded Memory Manager

.
.
.

mov     dx,seg emname      ; attempt to open* EMM...
mov     ds,dx              ; DS:DX = address of EMM
mov     dx,offset emname   ; logical device name
mov     ax,3d80h           ; fxn. 3DH = open
interrupt 21h              ; transfer to MS-DOS
jc      error              ; jump if open failed

                                ; open succeeded, make sure
                                ; it was not a file...
mov     bx,ax              ; BX = handle from open
mov     ax,4400h           ; fxn. 44H subfun. 00H =
                                ; IOCTL get device info.
interrupt 21h              ; transfer to MS-DOS
jc      error              ; jump if IOCTL call failed
and     dx,80h             ; bit 7=1 if char. device
jz      error              ; jump if it was a file

                                ; EMM is present, make sure
                                ; it is available...
                                ; (BX still contains handle)
mov     ax,4407h           ; fxn. 44H subf. 07H =
                                ; IOCTL get output status
interrupt 21h              ; transfer to MS-DOS
jc      error              ; jump if IOCTL call failed
or      al,al              ; test device status
jz      error              ; if AL=8 EMM not available

                                ; now close handle ...
                                ; (BX still contains handle)
mov     ah,3eh             ; fxn. 3EH = close
interrupt 21h              ; transfer to MS-DOS
jc      error              ; jump if close failed
.
.
.

```

**Figure 3:** The code shown above tests for the presence of the Expanded Memory Manager (EMM) using the DOS "open" and "ioctl" functions.

supports four times as much expanded memory as Version 3.2, and it provides many additional function calls for use by multitasking operating systems. EMS 4.0 theoretically even allows an operating system to run multiple applications at the

same conventional memory addresses by paging the applications in and out of expanded memory. As of this writing, however, EMS 4.0 has not become generally significant for software developers, since full exploitation of its capabilities requires hardware assistance that is not available on older EMS boards. Some of the characteristics of the three versions of EMS are compared in Figure 2.

The things we don't know about the history of EMS would certainly be a lot more interesting than much of what we do know. For example, how did the engineers at Intel's obscure Hillsboro, Oregon, outpost ever manage to link up with programmers at the ordinarily staid and conservative Lotus Corp. to create this new memory standard? How many changes in EMS 3.2 and EMS 4.0 were really driven by Microsoft's schemes for forthcoming versions of *Windows*? The long-range im-



## THE EVOLUTION OF EMS

EMS version	Release date	Memory supported	Function calls	Page size	Page mapping
3.0	April 1985	8MB	14	16K	Above 640K
3.2	September 1985	8MB	18	16K	Above 640K
4.0	October 1987	32K	58	Any size	Anywhere

Figure 2: EMS 4.0 represents a considerable step upward from the previous versions. The numbers of function calls shown here include all distinct subfunctions defined in the standard.

## Power Programming

plications of EMS are thought-provoking, too. How long, for example, will EMS delay the acceptance of OS/2 by prolonging the lives of DOS applications and of real-mode multitasking managers like *Windows* and *DESQView*?

### USING EXPANDED MEMORY

When you install expanded memory in your computer, you're really installing a closely integrated hardware/software subsystem. (I'm ignoring EMS emulation by 80386-specific programs such as *386-to-the-Max* for now.) The hardware portion is a plug-in that resembles an ordinary memory board in some respects and in other ways is like an adapter for a peripheral device. Thus, it has memory chips, but it also has I/O ports to which the CPU must write to make portions of that memory addressable.

The software component of an expanded memory subsystem is called an Expanded Memory Manager (EMM). Like a device driver, it is installed when the system is booted, using a `DEVICE=` directive in the `CONFIG.SYS` file. In fact, an EMM has several other attributes of a real-character device driver: it has a device



## THE MOST-USEFUL EMS FUNCTIONS

Expanded memory function	Call with	Returns
Get status	AH = 40H	AH = status
Get page frame address	AH = 41H	AH = status BX = page frame segment
Get number of expanded memory pages	AH = 42H	AH = status BX = available pages DX = total pages
Allocate expanded memory pages	AH = 43H BX = no. of pages	AH = status DX = EMM handle
Map expanded memory page	AH = 44H AL = physical page BX = logical page DX = EMM handle	AH = status
Release expanded memory pages	AH = 45H DX = EMM handle	AH = status
Get EMM version	AH = 46H	AH = status AL = version

Figure 5: Many memory boards can't take advantage of the new EMS 4.0 functions, but this subset of EMS functions should be safe to rely on.

driver "header"; it has routines that can handle a subset of the requests that the DOS kernel likes to make on device drivers; and it has a "logical device name." An EMM always has the device name `EMMXXXX0`, regardless of who manu-

factures the expanded memory board or writes the EMM.

But the device driver aspects of an EMM are really tangential. Its main job is to control the expanded memory hardware, to administer expanded memory as a system resource that may be used by many different programs at once, and to service the function calls that are defined in the EMS. Programs request these expanded memory functions from the EMM directly by means of software interrupt 67h. DOS does not participate at all in servicing these requests.

When you want to use expanded memory in one of your programs, the first step is to determine whether the EMM is present or not. This can be accomplished by one of two methods. The first is to "open" the EMM by its logical name with interrupt 21h function 3Dh—just as if it were a character device or a file. You must then make sure that you haven't accidentally opened a real file with the same name; to do so, you use two of the interrupt 21h function 44h (IOCTL) subfunctions and subsequently "close" the EMM with interrupt 21h function 3Eh. The latter step avoids the needless waste of a handle you can't use anyway. This procedure is shown in Figure 3.

The other method of detecting the EMM relies on the fact that, if installed, the EMM will (of necessity) have captured

TESTING FOR EMS (2)	COMPLETE LISTING
<code>emminterrupt equ 67h</code>	; Expanded Memory Manager
	; software interrupt
<code>emname db 'EMMXXXX0'</code>	; guaranteed device name for
	; Expanded Memory Manager
<code>.</code>	
<code>.</code>	
<code>xor bx,bx</code>	; first fetch segment from
<code>mov es,bx</code>	; EMM interrupt vector
<code>mov es,es[(emminterrupt*4)+2]</code>	
	; assume ES:0000 points to
	; to base of the EMM...
<code>mov di,10</code>	; ES:DI = address of name
	; field in driver header
<code>mov si,seg emname</code>	; DS:SI = EMM driver name
<code>mov ds,si</code>	
<code>mov si,offset emname</code>	
<code>mov cx,8</code>	; length of name field
<code>cld</code>	
<code>reps cmpsb</code>	; compare names...
<code>jnz error</code>	; jump if driver absent
<code>.</code>	
<code>.</code>	
<code>.</code>	

Figure 4: The alternative method of testing for the presence of a previously loaded EMM is to inspect its interrupt vector and device driver header.



## Power Programming

the vector for interrupt 67h, placing the address of its EMS function-call entry point in the vector. An application program testing for the presence of an EMM thus simply fetches the contents of the vector and determines whether the segment portion points to a device driver header that contains the logical device name EMMXXXX0 (see Figure 4). This is not a very well-behaved way for an application program to act, since it involves inspecting memory that does not belong to the program. But it is the only reliable way for a device driver that needs expanded memory to test for a previously loaded EMM. This is because, at the time when device drivers are being loaded, DOS has not yet been fully initialized and most DOS interrupt 21h functions (including "open") are not yet available.

Once your program has established that an EMM is installed, it can proceed to invoke the various EMS functions via interrupt 67h. The first order of business is to call the EMM's status function to make sure the expanded memory hardware is present and working properly. Next, the "get version number" function should be called; this ensures that all of the EMS functions the program needs are supported by the particular EMM that is installed on the system in use. After that, your program can query the EMM to find out how much expanded memory is available, allocate some of the expanded memory pages, and proceed to put that memory to work.

If you look in any of the popular DOS reference books, or in the EMS 4.0 spec itself, you'll soon find yourself in a bewildering maze of EMS function calls. For the purposes of a normal application program, however, you can ignore all of the functions that were added in EMS 4.0 and restrict yourself to a rather small subset of the EMS 3.2 functions. In addition to the "get status," "get version," and "get available pages" calls already mentioned, you need only be familiar with the "allocate pages," "get page frame address," "map pages," and "deallocate pages" functions. (The "page frame" is a 64K area above the 640K boundary into which expanded memory pages are mapped for access by the program.)

As you can see in Figure 5, the subset of EMS functions I've just outlined is straightforward to use and reasonably

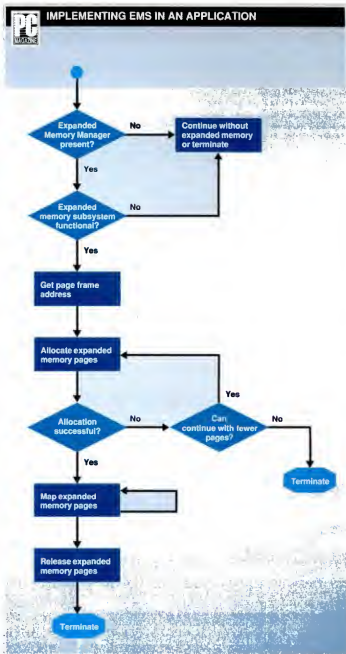


Figure 6: This flow chart shows the general procedure by which application programs use expanded memory. The use of expanded memory by TSRs or device drivers is more complex and is not discussed in this column.

## Power Programming

symmetrical. For example, the EMS function number is always placed in register AH, logical page numbers typically go in register BX, expanded memory handles (not to be confused with file or device handles) go in register DX, and so on. All EMS functions indicate success by returning 0 in register AH, or failure by returning an error code in AH with the most significant bit set.

A sketch of the entire process of using expanded memory in an application is shown in Figure 6, and my next column will provide some practical examples in

**Your application  
program must release  
its expanded memory  
pages before  
terminating, or those  
pages will be lost until  
the system is  
restarted.**

the form of a useful utility program. One thing you should note even now, however: it is very important that your application program release its expanded memory pages before terminating. Otherwise those pages will be lost for use by other programs until the system is restarted. Since DOS does not participate in expanded memory management, it can't clean up expanded memory allocation when a program terminates unexpectedly; by contrast, DOS automatically releases conventional memory allocations and file and device handles.

### THE IN-BOX

Please send your questions, suggestions, and comments to me at any of the following e-mail addresses:

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CIRCLE 389 ON READER SERVICE CARD

# Aw...What the Heck!

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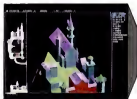
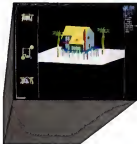
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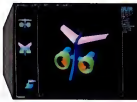


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by  
Douglas Cobb  
and Steven Cobb

# Spreadsheet Clinic

## REDIRECTING YOUR CURSOR

When you are defining or redefining any range within 1-2-3, you can use the period key to move the "anchor" and "free" cells to the various corners of that range. The anchor cell is the cell that remains fixed when you press the Arrow keys to expand or contract the range. The free cell is the cell in the corner opposite the anchor cell. The address in the control panel always will list the anchor cell first, followed by the free cell. A small, blinking, underline cursor always appears in the free cell.

In most cases, 1-2-3 will move the anchor and free cells around a range in a clockwise direction when you press the period key. For example: if you highlight cells C3..E5, cell C3 will be the anchor cell, and cell E5 will be the free cell. If you press the period key, cell E3 usually becomes the anchor cell, and cell C5 becomes the free cell.

Sometimes, however, 1-2-3 will move the anchor and free cells in a counterclockwise direction. Or, using the example above, cell C5 may become the anchor cell, and cell E3 may become the free cell.

After some experimentation, I found the explanation for this behavior. If you press the period key an even number of times while defining a range, the cursor will move in the same direction the next time you define a range. If you press the period key an odd number of times, however, 1-2-3 will move the cursor in the opposite direction the next time you define a range.

1-2-3 defaults to moving the cursor in a clockwise direction. Therefore, as long as you continue pressing the period key an even number of times when defining ranges, 1-2-3 will continue moving the cursor in a clockwise direction. If you ever press the period key an odd number of times, however, 1-2-3 will start moving the cursor in a counterclockwise direction the next time you define a range. To get the cursor moving in a clockwise direction again, you'll have to press the period key an odd number of times.

Apparently, 1-2-3 does not reset the direction in which it moves the cursor until

■ **REDIRECTING YOUR CURSOR:** How to determine the direction of your cursor in a highlighted range.

■ **COPYING COLUMN WIDTHS:** An easy way to copy column widths in Excel and 1-2-3.

■ **LINKING WORKSHEETS:** A new add-in for 1-2-3 and Symphony lets you dynamically link worksheets.

■ **EDITING 1-2-3 FORMULAS:** Editing copies of long formulas may produce unexpected results.

you exit from 1-2-3 and then reload it. Simply retrieving a new worksheet does not return the direction of movement to clockwise.

Since you can see the direction the cursor is moving around a range when you are pressing the period key, there's no need to be careful about pressing it an even number of times. However, if any of your macros move the cursor around a range while defining it, you should always be sure that the cursor is set to move in the correct direction before you invoke the macro, and that the macro always presses the period key an even number of times.

For example, to remove any blank rows from the bottom-left of a print range, make sure that the cursor is moving in a clockwise direction before invoking the macro

/ppr. (end) copy ~

The period following the keyword (Up) does

not alter the effect of the macro. However, it does assure that the cursor will continue to move in the same direction the next time you use the period key while defining a range.

Rexford H. Swain  
Washington, Connecticut

**PC**  
MAGAZINE

This is right—the number of times that you press the period key when defining a range does affect the direction the cursor will move the next time you define a range.

However, the period key is not the only key that can change the direction of the cursor. In some cases, the Arrow keys will reverse the direction of the cursor. Specifically, if you use the Arrow keys (not the period key) to "flip" the range so that the anchor cell is in a different corner, 1-2-3 will begin moving the cursor in the opposite direction immediately.

Suppose that cells C3..E5 were highlighted, cell C3 was the anchor cell, cell E5 was the free cell, and the period key was moving the cursor in a clockwise direction. If you pressed the Left Arrow key four times, cells A3..C5 would be highlighted, and cell A5 would be the free cell. Cell C3 would still be the anchor cell, but it would be at the upper-right corner of the range instead of at the upper-left corner. Consequently, the cursor would now move in a counterclockwise direction if you pressed the period key again.

Unlike the change in direction imposed by the period key, the one that's caused by "flipping" a range is temporary. The direction in which 1-2-3 moves the cursor the next time you define a range is based on the direction it was moving before you flipped the range—not the direction it was moving afterwards.

Let's again suppose that cells C3..E5 were highlighted, cell C3 was the anchor cell, cell E5 was the free cell, and the period key was moving the cursor in a clockwise direction. If, before you pressed the period key, you pressed the Left Arrow key four times, cells A3..C5 would be

## Spreadsheet Clinic

highlighted, cell C3 would still be the anchor cell, and cell A5 would be the free cell. If you pressed the period key now, 1-2-3 would move the cursor in a counterclockwise direction. If you pressed the period key an even number of times, 1-2-3 would resume moving the cursor in a clockwise direction the next time you defined a range. If you pressed the period key an odd number of times, 1-2-3 would move the cursor in a counterclockwise direction the next time you defined a range.

### COPYING COLUMN WIDTHS

Assigning the width of one column in an Excel worksheet to another column is usually a bothersome chore. You select a cell in the desired column, pull down the Format menu, select the Column Width command, write down the width that appears in the Column Width box, and then click OK or Cancel to end the command. Then go to a cell in the column to be resized, reissue the Format Column Width command, type the previously noted width, and click OK.

There's an easier way. You start, as before, by issuing a Format Column Width command on a cell of the proper width. Then, however, you click OK without even bothering to look at the entry in the Column Width box. Now select a cell in the column to be changed, pull down the Edit menu, and pick the second command on that menu. Since you've just finished issuing the Column Width command, this command will be Repeat Column Width. Excel will then assign the width of the previous column to the column that contains the selected cell.

Richard Sands  
Portland, Oregon



The second command on Excel's Edit menu provides an easy way to reissue any repeatable command. If, for example, you issue the Copy command followed by the Paste command, the second command on the Edit menu will be Repeat Paste. When you issue this command, Excel will reissue the Paste command, creating another copy of what you pasted into another cell previously. If the last command that you issued is not repeatable, the second command on the Edit menu will be the inactive command Can't Repeat.

Although 1-2-3 does not feature a command that assigns the width of one column to another, you can create a simple macro that does. The macro shown in Figure 1 assigns the width of the column in your current cell to the column into which you subsequently move the cell pointer.

The macro starts by entering the width of the current column into the cell named WIDTH (B5). The second statement displays a prompt, points to the destination column at the top of the screen, and waits for you to press Enter. Once you do, 1-2-3 lets you move the cell pointer to the column to which you want to assign the designated width.

Now when you press Enter, 1-2-3 issues its /Worksheet Width Set command, types in the width stored in WIDTH (B5), and hits Enter. This assigns the width of the column to that of the originally specified column.



**LINKING WORKSHEETS**  
A new add-in application for Lotus 1-2-3 and Symphony, @WSLINK, lets you dynamically link one worksheet to another. It adds the new function @WSLINK to 1-2-3, letting you reference information in any cell of any worksheet on your disk.

The form of the @WSLINK function is

```
@WSLINK("filespec", "cell")
```

where *filespec* is the name of and path to the worksheet file from which you want to extract information, and *cell* is the name or address of a cell in that worksheet. For example, the function

```
@WSLINK("c:\123\files\test", "B5")
```

references cell B5 in a worksheet that is stored in the file named TEST.WK1, which is located in the c:\123\FILES directory.

@WSLINK gives you several ways to reference a cell. If you wish, you can reference cells by a range name instead of the address. You can also reference a cell by specifying the number of cells above, below, to the left of, or to the right of a cell containing a particular label. Or you can reference the first nonblank cell in any direction, using a cell containing a certain label as a starting point.

If the referenced cell contains a value, the @WSLINK function will return that value. If it contains a label, the @WSLINK function will return the string equivalent of that label. If the referenced cell contains a formula or a function, the @WSLINK function will return the result of that formula or function.

The @WSLINK function creates a dynamic link between the worksheet that contains it and the worksheet that it references. Therefore, if you alter the entry in the cell referenced by the @WSLINK function, @WSLINK will return a different result the next time you recalculate the worksheet that contains it.

For purposes of recalculation, 1-2-3 treats the @WSLINK function just like any other function. Whenever 1-2-3 recal-

1-2-3 MACRO				COMPLETE LISTING				
	A	B	C	D	E	F	G	H
1	\w	{Let WIDTH,@STRING(@CELLPOINTER("width"),@)}						
2		{GetLabel "Press [Enter], then point to the destination column..." ,NULL}						
3		{?}{Esc}						
4		/wcs						
5	WIDTH	-						
6								
7								
8	NULL							
9								

Figure 1: This 1-2-3 macro copies the width of one column to another column in the same worksheet.



## Spreadsheet Clinic

culates an @WSLINK function, it looks at the file allocation table (FAT) of the disk on which the file that @WSLINK references is stored. 1-2-3 checks the FAT to see if that file has been saved since the last time the @WSLINK function was recalculated. If it has been, 1-2-3 will recalculate the @WSLINK function. If it has not been saved, 1-2-3 will not recalculate the @WSLINK function.

The @WSLINK add-in uses a maximum of 19K of memory and carries a suggested retail price of \$49.95. To order a copy, call Goldata Computer Services at (215) 525-1098.

### EDITING 1-2-3 FORMULAS

Recently, I entered a long formula into a cell in row 1 of a 1-2-3 worksheet. Then I copied that formula into a cell in row 100. At first, the copy of the formula returned the correct result. But after I brought the formula to the Edit line and pressed the Enter key to lock it back into the cell, the formula gave a different answer. Can you explain what is happening here?

Joseph J. Martella  
Weehawken, New Jersey

**PC** We sure can. 1-2-3 allows you to type a maximum of 240 characters into any cell. However, this restriction doesn't apply to a formula that's copied from another cell.

When you copy a formula that contains relative references, 1-2-3 changes the references to suit the new location. Depending on the length of the formula and its new location in the worksheet, the copy of the formula may grow to more than the 240-character limit.

For example, when you copy the 198-character formula

```
L6: +A1+A2+A3+A4+A5+A6
    +B1+B2+B3+B4+B5+B6
    +C1+C2+C3+C4+C5+C6
    +D1+D2+D3+D4+D5+D6
    +E1+E2+E3+E4+E5+E6
    +F1+F2+F3+F4+F5+F6
    +G1+G2+G3+G4+G5+G6
    +H1+H2+H3+H4+H5+H6
    +I1+I2+I3+I4+I5+I6
    +J1+J2+J3+J4+J5+J6
    +K1+K2+K3+K4+K5+K6
```

from cell L6 into cell L106 of your work-

sheet, 1-2-3 changes it into the following formula:

```
L6: +A101+A102+A103+A104+A105+A106
    +B101+B102+B103+B104+B105+B106
    +C101+C102+C103+C104+C105+C106
    +D101+D102+D103+D104+D105+D106
    +E101+E102+E103+E104+E105+E106
    +F101+F102+F103+F104+F105+F106
    +G101+G102+G103+G104+G105+G106
    +H101+H102+H103+H104+H105+H106
    +I101+I102+I103+I104+I105+I106
    +J101+J102+J103+J104+J105+J106
    +K101+K102+K103+K104+K105+K106
```

Fortunately, 1-2-3 will accept the formula even though it exceeds the 240-character limitation. However, it will not allow you to type or edit a formula longer than 240 characters.

When you select Edit, 1-2-3 brings only the first 240 characters of a formula to the Edit line. If you press Enter at this point, 1-2-3 will attempt to lock the truncated formula into the worksheet. If the first 240 characters are a valid formula, 1-2-3 will accept the truncated formula and return its result. If they're not a valid formula (the more common occurrence), 1-2-3 will simply beep when you hit the Enter key.

There's no good way to work around this problem. If you notice that 1-2-3 truncates a formula when you bring it to the Edit line, press the Esc key instead of the Enter key; 1-2-3 won't replace the formula with a truncated version then. If you must edit a formula, however, copy it back toward the upper-left corner of the worksheet, edit it, and then copy the edited formula back to the lower-right corner of the worksheet.

In most cases, it's better to break the formula into two parts, each of which contains fewer than 240 characters. To do this, you must divide the original formula (the one in the upper-left corner of your worksheet) into two parts before you copy it down and to the right.



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## PC MAGAZINE EDITOR'S CHOICE FACT FILE

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(612) 553-0111

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by  
Neil J. Rubenking

# User-to-User

## HOW TO PRINT FILES AND THEIR NAMES

When I have repetitive jobs to do, I write a batch file to handle them for me. Thus, as you can imagine, my hard disk is littered with .BAT files, and although I try to use descriptive filenames, it's easy to lose track of what each does. In the March 31, 1987, issue's User-to-User column, Deena Eliossoff suggested a method for scanning a number of .BAT files on the screen. I wanted to get a hard copy instead so that I could refer to the files whenever necessary, so I started experimenting with redirecting the output. I found that I could do this with the following COPY command:

```
COPY *.BAT PRN > PRN
```

When you enter this command you get a printout of the filenames followed by the contents of each file. This will work for any files saved in straight ASCII text format.

Bill Harwell  
Chehalis, Washington



When you copy a group of files to PRN, DOS simply sends them to the printer. As it copies each file, it lists the name on the screen. By redirecting the output of the COPY command to the printer, you get the name printed before the contents of each file. If you just want to experiment with this method, you can save some paper by copying to the CONSOLE instead:

```
COPY *.BAT CON > CON
```

Use Ctrl-S or Ctrl-NumLock to suspend the display, then hit any key to start it again. Here's a tip: spell out the full pathname even if the files you want are in the current directory. For example,

```
C:\DOS\UTIL\BAT\*.BAT
```

This way you'll get the full pathname printed with each. Do note that there will be no breaks between the files.

■ **HOW TO PRINT FILES AND THEIR NAMES:** Get a printout of filenames followed by the contents of each file.

■ **ELIMINATING REDUNDANT TESTS:** Performing only necessary tests in batch files speeds execution.

■ **LIST ONLY FILES CREATED "TODAY":** Create an environmental variable with a date format DIR can use.

■ **SNEAK A LOOK AT ANY DISK'S BOOT SECTOR:** Examining the first sector of a diskette with DEBUG.

■ **ONE BIG BATCH FILE SAVES DISK SPACE:** Combining many batch files can save thousands of bytes.

## ELIMINATING REDUNDANT TESTS

I often see .BAT files that contain a series of statements such as

```
IF %1.==. GOTO :ABORT  
IF %2.==. GOTO :ABORT  
IF %3.==. GOTO :ABORT
```

The purpose, of course, is to verify that the correct number of parameters (in this example, three) have been entered on the command line. But are the first two statements necessary? If %3 is present, by definition %1 and %2 must also be present. If a certain batch file requires five parameters, why not shorten the program and speed its execution by testing only for %5?

I have experimented with batch files,

testing only for the highest numbered parameter, and they have worked as well as when I've included tests for all required parameters. I even entered fewer parameters than required and tried to fake out the program by entering multiple spaces or commas, but I was never able to trick the program into accepting the wrong number.

Raymond Konstanty  
Wood-Ridge, New Jersey



Mr. Konstanty is quite correct. The existence of a given parameter proves the existence of all lower-numbered parameters. And since each line of a batch file takes time to execute, it's worthwhile to eliminate useless ones. I try to make a point of editing out multiple parameter tests from batch files in this column.

## LIST ONLY FILES CREATED "TODAY"

In the August 1988 issue's User-to-User column, Michael Trombetta described a method for "Once-a-Day" batch files. In the November 29, 1988, issue, Allen Easley modified this method to set an environment variable to the current date. I decided to use these techniques to make a directory listing of only those files created or modified during the current workday.

At first I thought I could just use the environment variable TODAY with the FIND command to create a directory list of such files, but the task turned out to be a little more complicated than this. TODAY stores the date as MM-DD-YYYY, while the DIR command displays the date as MM-DD-YY. I solved this problem by using Mr. Trombetta's method and entering the following batch lines:

```
ECHO | MORE | DATE > READDATE.BAT  
EDLIN READDATE.BAT < EDLIN.SCR > NUL  
READDATE
```

The first line that you see puts the current date into a batch file. The next one modifies the date format in READDATE.BAT using



## User-to-User

the EDLIN script file

```
1R-198"Z-0  
Z
```

(Note: the "Z" represents a single Ctl-Z character, not the two-character sequence displayed above. EDLIN can create this file but cannot edit it again—if you reload it, ED-

Using EDLIN scripts to  
modify files  
dynamically is not  
extremely fast, but it  
opens up new  
horizons in what you  
can do with batch files.

LIN will interpret the "Z" as end of file.) Finally, READDAT.BAT executes, invoking CURRENT.BAT:

```
SET TODAY=14
```

Once the date format of TODAY was the same as the one displayed by the DIR command, I created DIRT.BAT:

```
DIR &1 | FIND "TODAY" | FIND /V *
```

It displays only those files created "today." The first FIND command selects files made today; the second one filters out lines containing "0" (space, zero, space). This is done to remove the temporary files created in the pipe process from the listing.

Curt Finley  
Davis, California



Using EDLIN scripts to modify files dynamically opens up new horizons in what you can do with batch files. Of course it's not extremely fast, but if it makes the difference between automating a process and doing it by hand, speed is not essential. In this case, the ED-

LIN modification is made only once, storing the result in the environment.

To use DIRT, attach the batch lines used to create READDAT.BAT to the end of your AUTOEXEC. Create the other files (EDLIN.SCR, CURRENT.BAT, and DIRT.BAT) in your batch directory. EDLIN must be available on the PATH, of course. Now each time you run AUTOEXEC, the environment variable TODAY will contain the date in a form that's useful with DIR. You may, of course, choose a more pleasant name.

### SNEAK A LOOK AT ANY DISK'S BOOT SECTOR

I've had problems with some operating systems being unable to read or write correctly to disks formatted by others. I therefore look sometimes at the boot sector of a diskette to check which operating system formatted it. Using *The Norton Utilities* seems like overkill just to look at one specific sector, so I developed the following DEBUG script, BOOT.B:

```
L 100 1 0 1  
D 100 L 20  
D 100 2FF  
Q
```

Now by typing

```
DEBUG < BOOT.B
```

I can examine the boot record of the disk in drive B: (essentially the OEM identification in the first two lines, and the error messages in the ones following). In order to look

at drive A:, you have to change the first line to: L 100 0 0 1.

Ricardo Palma  
San Ysidro, California



Here's a little background on the boot sector. When you turn on your computer, it goes through a Power On Self Test (POST) process that's built into the ROM. At this point, the computer has no access to the functions in the operating system files, IBMDOS.COM, IBMBIO.COM, or COMMAND.COM. It knows nothing about files or directories, but it can load a disk sector. After the POST, it loads the first sector of the boot disk and executes it. This sector contains the "bootstrap loader," a program that loads and runs IBMDOS.COM and IBMBIO.COM, which in turn run COMMAND.COM. Each program loads a higher-level program until your system is fully operational.

Besides the bootstrap loader code, the boot sector contains parameters that describe the disk itself. Bytes 3 through 10 identify which operating system formatted the disk—the OEM ID mentioned above. Figure 1 lists the parameters contained in bytes 11 through 29 (0Bh—1Dh).

Everything in the boot sector is essential. A damaged byte in the bootstrap loader will make the disk unbootable. And certain changes in the disk parameters can create a "killer" disk. Merely trying to read the directory of such a disk will hang your computer. It's safe enough to read the contents of the boot sector, as explained above, but don't write anything to it!



### DISK PARAMETERS CONTAINED IN THE BOOT SECTOR

Offset	Bytes	Description
0Bh	2	Bytes per sector
0Dh	1	Sectors per cluster
0Eh	2	Reserved sectors
10h	1	Number of FATs
11h	2	Number of root-directory entries
13h	2	Total sectors in volume
15h	1	Media descriptor byte
16h	2	Sectors per FAT
18h	2	Sectors per track
1Ah	2	Number of heads
1Ch	2	Number of hidden sectors

Figure 1: The first sector of every disk contains this important information that the computer uses during boot-up.

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## User-to-User

### ONE BIG BATCH FILE SAVES DISK SPACE

I used to start each of my application programs with a separate batch file. Each contained commands to change the current subdirectory, install the right driver sets (for

example, a mouse driver), set the necessary variables in the DOS environment, and so forth, and then run the application. Although the average size of each batch file was less than 50 bytes, DOS allocates a minimum of 2,048 bytes for every file, thus wasting precious space on my 10MB PC-XT hard disk.

To save disk space, I wrote a generic batch file, RUN.BAT, shown in Figure 2.



Figure 2: Make your own version of RUN.BAT by combining many small batch files into one.

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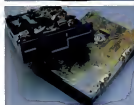
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## User-to-User

The GOTO labels used within RUN.BAT, which reflect the names of my applications, are the names of my former batch files (123.BAT, CAD.BAT, and so on). I could then eliminate all my individual batch files plus the subdirectory in which they resided, saving thousands of bytes.

The only difference in the way I used to run my applications and the way I run them now is that I have to prefix the old batch file names with the word RUN—for example, RUN 123 instead of just 123. If no parameters are passed to RUN.BAT, it displays a screen showing the programs available to be executed.

Ray G. Carolina  
Poughkeepsie, New York

**PC** This is a dandy idea if you're short on disk space, and especially if your disk has large clusters (cluster size normally ranges from 1K to 4K). Of course, it will make batch-loading your programs somewhat slower because DOS has to search the batch file for the appropriate

label. Putting your most-used programs at the top of the list will certainly speed their loading, but there'll be a correspondingly longer wait after you finish using your application when DOS is looking for the label End.

To avoid that annoying delay after running your programs, you can replace all of the GOTO End lines with a simple call to QUIT. Next you need to create a batch file called QUIT.BAT that has 0 bytes. A file with even 1 byte takes a full cluster of disk space, but one with 0 bytes uses up nothing more than its directory entry. To create QUIT.BAT, you must issue the following command:

```
REN > QUIT.BAT
```

Do this in your batch directory because DOS won't copy zero-length files. Now when you finish with an application, your batch file can quit immediately rather than seeking the label End.

To create your personal RUN.BAT, just copy all of your individual application batch files into one big file. At the beginning of each, put in a label with its name, for example :WP. At the end of the file cre-

ate the syntax label followed by ECHO statements to list the possible applications. At the start, insert the two lines IF %1==x GOTO %syntax and GOTO %1. You're almost done.

There are two things you may need to change in your version of RUN.BAT. First, if any of your batch files used replaceable parameters, you will need to replace each of the numbers by one since the %1 parameter now determines which subbatch is going to be used. Second, you need to look for any conflict in label names. If you have several labels called End, for example, just tack a different number onto each to make it unique, as in End2. Now you're ready to RUN.

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edited by  
Craig L. Stark

# Power User

## HIGH ASCII IN WORD

In the September 13, 1988, Power User column, M. David Stone noted that if *SuperKey* is loaded, Microsoft Word can no longer generate special characters with the Alt key and numeric keypad. He then showed how to set up Word macros to temporarily suspend *SuperKey* in order to generate the high ASCII characters.

In fact, there is a much easier way. *SuperKey* interprets key combinations such as Alt-Home and Alt-PgDn as macros. However, holding down the Shift key simultaneously with Alt and then the numeric keypad combination overrides this assumption and gives the same result as if the resident *SuperKey* were suspended.

Sammy Chan  
West Brookport, New York

**PC** MAGAZINE  
Bravo! A few minutes at my system confirmed that holding down the Shift key together with the Alt key lets you enter high-order ASCII characters from the numeric keypad not only with *SuperKey*, but with *ProKey*, *SmartKey*, *Flash-Up*, *Keyworks*, and even *NewKey*, in all of the versions of each program that I have.

A much longer, and mostly fruitless, search through the manuals for these programs shows that this feature is poorly documented—or not documented at all—in every case. The *ProKey* manual mentions it in a section called "Using ProKey With Other Programs," but only in relation to *Volkswriter*.

There is some logic in holding down the Shift key to shift to the numbers on the numeric keypad. But perversely enough, turning on NumLock does no good. You should also note, though, that this feature applies only to using the Alt key and numeric keypad. It is not a general-purpose skip command that will let you ignore a macro and regain the original function of a key. Most, if not all, keyboard macro programs do include a skip command, but it usually requires several keystrokes.—M. David Stone

■ **HIGH ASCII IN WORD:** Here's an easy way to access the high-order characters when you've got a keyboard macro program loaded.

■ **FILE INSECURITY:** Your secret WordPerfect documents may be fully accessible to anyone who can unerase a file.

■ **TEMPORARY TABS:** How to return to original tab or other formatting settings in WordPerfect.

■ **LEANER DISK FILES IN WORDPERFECT:** Get back some disk space by saving WordPerfect 5.0 files without their prefix.

## FILE INSECURITY

Readers of this column are no doubt aware that the DOS DEL command does not erase a file's data. For complete security you need a program—such as Peter Norton's *WIPEFILE*—that actually overwrites the data. But *WordPerfect* users probably have far greater problems than they imagine. Because *WordPerfect* creates copies of your document and then deletes the filenames, you may not even be able to use *WIPEFILE* effectively.

Consider, for example, the "timed backup" feature, which will create a file (WP)BACK.1 (or (WP)BACK.2 for document 2). This file is "deleted" when you exit *WordPerfect*, but its data is still there on your disk. You'll find it in the directory with WP.EXE, from which it can be recovered with any unerase program.

Further, when you save a document a second time, the first copy is simply re-

named (it changes its extension to BK!) and a new copy is written to disk. A third save re-names the second and deletes the filename of the first. But you now have three copies of the file on your disk.

*WordPerfect* partisans will be quick to suggest that you can turn off the option. Unfortunately, however, you really can't, if it is turned off, *WordPerfect* does exactly the same thing, though it erases the original filename. Even with all of *WordPerfect*'s backup features turned off, after three saves you still have three copies of the file on-disk. Besides the file itself, one copy is a complete recent backup and can be un-erased. Another may not be a complete backup, and has no directory entry, but it can be found and read with any low-level disk editor.

If you are using *WordPerfect*'s "locked file" option, be sure to use it the first time you save the file. Otherwise, one or more plain-text backup copies will exist. Note, too, that the "timed backup" file is not enciphered and is present on-disk, recoverable, and easily read by anyone.

Since these files—or rather, their filenames—are "deleted," utilities such as *WIPEFILE* can't locate them and over-write them. You will need a command (for example, Norton's *WIPEDISK*) which will write over all "erased data space." Even in this instance there might be some concern that portions of your data could be found in the unused space of another file's block.

Joseph H. Noggle  
Wilmington, Delaware

**PC** MAGAZINE  
Multiple copies of data from your documents remain on-disk until those disk areas get reused for another file. Unfortunately, you have no way of knowing when that will occur. If your files need to be totally safe from prying eyes, perhaps you should simply work from floppy disks and lock up the disks when they're not being used.

As Mr. Noggle says, the DOS DEL and ERASE commands do not erase a file's data from your disk. They merely erase the

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## Power User

file's directory entry and mark all of its disk space as "available." Erasing a file is like throwing a document into a wastebasket—if someone is willing to get a little dirty, he can retrieve the file.

The January 3, 1988, release of *WordPerfect* 5.0 adds a feature that will eliminate the problem described here. It includes an option to save a modified file directly on top of the original file. This feature was actually implemented primarily to help people save large files on floppy disks without getting a Disk Full error. But it serves as well to avoid having copies of your secret data proliferate on-disk. Be aware, however, that there's some danger in using this option, since if the power fails during a save, you'll lose the file completely. —Neil J. Rubenking

## TEMPORARY TABS

When you change tabs you often know that you'll want to return to the original tab settings later in the document. The *WordPerfect* 4.2 macro shown in Figure 1 makes this conversion easy. To use the macro, press Alt-T rather than access the tab menu by hitting <Shift-F8><1>.

The macro leaves a copy of your original tab settings in the document, together with a marker (TAB) showing you where they are to be restored. (Obviously, you'll delete this marker when you're through with it.) You then employ the usual Set Tabs menu to assign your temporary new tab settings. The original settings will be restored at the marker position in the document.

C. Michael Bell  
Walla Walla, Washington



The macro in Figure 1 was written for *WordPerfect*, Version 4.2, but requires only minor changes. In *WordPerfect*, Version 5.0, you enter the tabs menu by pressing 1 and T rather than 1 alone. Further, you must press F7 twice to leave that menu. With these changes the macro works fine with Version 5.0.

Note that you can use the same technique for other formatting commands that you want to change temporarily. Simply confirm first that accepting the current values with F7 or Enter inserts a copy of those values in the document.

It's hardly worth having a macro to get out of your temporary tab settings. Most likely it's simply a matter of moving down a line, deleting the marker, and just continuing. But if your marker is displaced in


TAB RESTORING MACRO		COMPLETE LISTING
<Ctrl-F10>	Begin macro definition	
<Alt-T>	Name it Alt-T	
<Shift-F8>	Line Format	
1	Tabs	
<F7>	Exit tabs menu (inserts current tab settings)	
<Esc>5<Left>	Put a marker to remind us where [Set Tab] is	
<Enter>	Move cursor to left of [Set Tab]	
<Left>	Insert hard return	
<Shift-F8>	Back up to previous line	
1	Line Format	
<Ctrl-F10>	Tabs	
<F7>	End macro definition	
	Exit tabs menu	

Figure 1: This *WordPerfect* macro puts a copy of your original tab settings and an identifying marker into your document so you can return from temporarily changed settings.


MARKER REMOVING MACRO		COMPLETE LISTING
<Ctrl-F10>	begin macro definition	
<Alt-U>	Alt-U for UNTAB	
<Home><Home><Up>	to document top	
<Alt-F2>N<TAB><F2><F2>	find the marker and replace with nothing	
<Ctrl-F10>	end macro definition	

Figure 2: After using the tab restoring macro shown in Figure 1, you can use this macro to remove the marker and leave the cursor at that position in your document.

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☐ **INDIVIDUAL CREDIT**. Complete sections "a" and "b" only.

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Date of Birth: _____		City _____ State _____ Zip _____	
Present Address: Street _____ Apt. # _____		Home Phone ( ) _____	
Date of Residence: Month _____ Year _____		Monthly Payment: \$ _____ Buy <input type="checkbox"/> Rent <input type="checkbox"/> Other <input type="checkbox"/>	
Previous Address: _____		Date of Residence: From _____ To _____	
Your Employer: (if self-employed, see rear panel) _____		Date of Employment: _____	
Employer's Address: Street _____		City _____ State _____	
Previous Employer: _____		Date of Employment: From _____ To _____	
Income from primary job support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for reporting this situation.		Monthly Income: Gross \$ _____ Net \$ _____	
Other Income: _____		I have received since: _____	
Name and Address of Nearest Relative Not Living With You: _____		Relationship _____	

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Include joint applicant's information, if joint account requested.		<input type="checkbox"/> Checking <input type="checkbox"/> Savings <input type="checkbox"/> Checking <input type="checkbox"/> Savings	
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Description of Business _____	Your Position _____
Your annual income from business: _____	Business annual income (gross) _____ (net) _____
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## Power User

the text you might want to use the additional macro that is shown in Figure 2. It removes the marker and it leaves your cursor in the spot where the marker was.—Neil J. Rubenking

### LEANER DISK FILES IN WORDPERFECT

Along with each document, *WordPerfect*, Version 5.0, stores a "prefix" that contains font and printer information. This information is needed to make documents interchangeable among different systems running *WordPerfect*.

Users who must store documents on floppy disks will soon discover, however, that this additional data often requires an additional disk cluster. Documents smaller than a cluster may require two clusters. The added space requirement of the prefix could halve the number of files a floppy disk can hold. Since many *WordPerfect* 5.0 users seldom exchange documents between systems, this loss of storage capacity doesn't benefit them.

I have found that you can eliminate the problem by blocking an entire document and storing the block rather than the document. The following macro performs that function:

```
(DISPLAY OFF)
{Home} {Home} {Home} {Up}
{Block} {Home} {Home} {Down}
(DISPLAY ON) {Save}
(PAUSE) {Enter}
```

The fix creates some new problems of its own, however. For one thing, when *WordPerfect* stores a block, it asks you if you want to replace an existing document, but it does not store the older version as a BKL file. Again, if you retrieve a document stored this way into a blank screen, *WordPerfect* will not use your initial codes. If you have used initial codes to make justification OFF the default, for example, *WordPerfect* will not pick up that code and will justify printouts.

The solution to this latter justification problem is for you to key in a space before retrieving the document. In that way, *WordPerfect* retrieves the document into a blank document rather than retrieving it into an empty screen.

Bob Clark, Jr.  
Los Angeles, California

**PC** In addition to the printer and font definitions, *WordPerfect* stores style information, graphic images, the document summary, and proportional-spacing tables in the prefix. When you save a document as a block, you lose all of those except the graphic images.

When you make a change that affects the prefix, *WordPerfect* creates a new "data packet" and marks the old packet for deletion. In versions before the November 15, 1988, release of *WordPerfect* 5.0, however, this deletion did not always take place. The result was that the prefix grew bigger and bigger. If you find that you are having this same problem, your best bet is to upgrade to the latest version. If you've upgraded and seem to be still having the problem, you need to delete your WP(WP).SET file in the *WordPerfect* directory and go through the setup process once again.

While you're waiting for your upgrade, however, here's a technique to create a new prefix with no wasted space. You would begin by using the same technique described above:

- clear your document
- type one space
- retrieve the file
- delete the space.

At this point, the document on-screen has no name. It looks just like the document you retrieved, but it's really a fresh, blank document that's had your file retrieved into it. I always save this file immediately, therefore, so as to get it on-disk with its fat-free prefix.

Retrieving a document this way wipes out the previous prefix and gives it a new one with your initial codes and default printer selections. This can be quite handy when you take a document from a coworker to manipulate on your own system. You'll avoid seeing "XYZ123.PRS not found" every time you load the file.—Neil J. Rubenking

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# Languages

## DEFENSE AGAINST COMPUTER VIRUSES

Recent publicity surrounding attacks by computer viruses indicates just how vulnerable most systems can be in certain situations. Most methods of detecting and preventing viral attacks rely on users to conscientiously check their software at regular intervals, comparing the software's current state with a state recorded at an earlier date when a given system was known to be free of viruses.

But programmers can help to ease the burden for users. Programs can be written in such a way that they are self-checking, examining themselves each time they are run, to ensure that no changes have been made since they were compiled. Done correctly, such a feature can be added without imposing undue overhead on execution time.

I've developed a generic self-examination method that can be incorporated into almost any C program in order to provide protection against a virus that seeks to add to or alter the program's code. It works by dividing an executable file into a number of blocks whose size can be specified by the user, calculating a CRC value for each block, and embedding the CRC values back into the compiled program. Each time the executable file is run, it performs a new CRC check and compares the values it gets at this time with the values that were stored in it immediately after it was compiled. If the new CRC values don't match the originals, then the program knows it has been changed—possibly by a virus.

The mechanism for doing this works in two phases. First, code that performs the CRC check is included in the program as well as an uninitialized buffer of known length and structure. Second, immediately after the program is compiled, CRC values are calculated by a special patch utility and written back to the buffer area embedded in the executable file. If a program is altered, the CRC values it calculates for itself won't match those generated by the patch program.

■ **DEFENSE AGAINST  
COMPUTER VIRUSES:** A  
means of incorporating  
self-checking antivirus  
protection into your  
programs.

■ **SPEED UP PROGRAMS:**  
Word alignment can  
speed up memory-  
intensive programs on  
80286 or 80386  
computers.

I've included the code for the patch utility and a sample C source file that illustrates what a program needs to do to protect itself from alteration. I think you'll agree that it provides an elegant solution to a perplexing problem.

Michael Caprio  
Honolulu, Hawaii



This is a clever way to help programs protect themselves against viral attacks. It's not just elegant, it's simple—and it doesn't require any overt action by the user.

As a means of error detection, Cyclic Redundancy Checking (CRC) is statistically more reliable than are checksum and parity checking methods. Using a 16-bit CRC value as these programs do, only an insignificant fraction of errors can possibly slip through. Thus, it is virtually impossible for a virus to alter a program's code or data in such a way that the CRC check could be fooled.

I modified your code somewhat to make sure that both modules are written to stand alone. Both programs—PATCH.C, shown in Figure 1, and NOVIRUS.C, shown in Figure 2—include a pair of functions called `crc_update()` and `crc_finish()`. In the real world of professional programming, these routines would probably be combined into a single source file, com-

plied, and then linked into other programs to avoid redundancy. Here, I explicitly included them in each source file so that the programs will compile and link by themselves.

Programs that intend to take advantage of this method of self-checking need to be modeled after NOVIRUS.C. The first call this program makes is to the function `check()`, which computes CRC values and compares them with the values calculated at an earlier time. If the comparison uncovers no discrepancies, `check()` returns 0 to indicate that the file's integrity has not been compromised. A return value of 3 means the CRC values don't match. If the `check()` function cannot find the executable file on-disk or if the executable file has not been initialized with PATCH, it returns the error codes 1 and 2, respectively. The `main()` function contained in NOVIRUS.C simply examines the value that is returned by `check()` and then prints a message accordingly.

Before NOVIRUS can perform a CRC comparison, the PATCH utility must be run with NOVIRUS.EXE as a command-line parameter. CRC values are stored in a structure named `avirus`, which is identified by the string "CAPRIOxDFO". In order to find where the linker has located `avirus` within the executable file, PATCH simply treats the executable image as a flat text file and searches until it finds the ID string. Once the identifier has been found, PATCH knows exactly where to write the CRC values. If NOVIRUS is executed immediately after it is compiled but before being massaged by PATCH, it will respond with the message "Program has not been PATCHed."

To try these programs out, compile and link PATCH.C, then do the same for NOVIRUS.C. Next, at the command line, type `PATCH NOVIRUS.EXE` (assuming PATCH is either in the current directory or in your path and that NOVIRUS.EXE is in the current directory). PATCH will ask you for the CRC block length you want to use (after telling you what the mini-

## Languages

mum permitted is), then will rewrite NOVIRUS.EXE to include the appropriate CRC values.

Now whenever you run NOVIRUS, it will report "Program is unaltered." It will continue to print this message every time it is run until it is changed. If you change even a single byte in NOVIRUS.EXE

(perhaps using DEBUG or a utility such as EXEMOD.EXE, which is supplied with many of Microsoft's language products, that directly modifies executable file headers) and run it again, it will answer with "Executable has been altered, possibly by a virus." Under normal circumstances, this would be your cue to attempt to determine how and why the program was changed.

You won't be able to use this method, of course, if your programs routinely mod-

ify themselves for configuration purposes. For example, if a program's default screen attributes are stored internally and a configuration program modifies the program's image on-disk to change the default, check() would detect the change and report that the program has been altered. An alternative—and a better programming practice—would be to store configuration data, along with any other information that is likely to be changed, in a separate file.

—Jeff Prossie

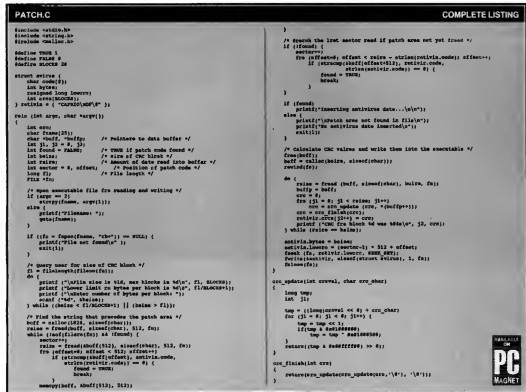


Figure 1: The code listing for PATCH.C, which implements a CRC checksum.



Figure 2: The code model for implementing the CRC checksum routine provided in PATCH.C.

# 386<sup>25</sup> • 286<sup>16</sup> WITH 2MB LOADED



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```

case 3:
    printf("Executable has not been patched!\n");
    break;
case 4:
    printf("Executable has been altered, possibly by a virus!\n");
    exit(1);
}

/*-----*/
/* Insert body of code here */
/*-----*/

}

checkchar *argp[] /* Function called to perform the CRC check */
{
    int c;
    char *buff; /*buff; /* Pointers to data buffer */
    int j, k = 0;
    int change = FALSE; /* TRUE if file altered */
    int i; /* Amount of data read into buffer */
    long fi; /* File length */
    FILE *fp;
    unsigned long bytcount; /* Position in file */
    unsigned long lower, higher; /* Position of areas patched */

    /* Open executable file for reading */
    if ((fp = fopen(argp[0], "rb")) == NULL)
        return(1);

    /* Return error code if PATCH utility hasn't been run */
    if (activator_crc[0] == 0 && activator_crc[2] == 0)
        return(2);

    /* Calculate and compare the CRC values */
    buff = malloc(activator_bytes, sizeof(char));
    lower = activator_lower &= sizeof(activator_code) + 1;
    higher = activator_lower &= sizeof(activator_code);

    do {
        raise = fread(buff, sizeof(char), activator_bytes, fp);
        buff = buff;
        c = 0;

        for (j = 0; j < raise; j++) {
            bytcount++;

            if (bytcount >= lower) && (bytcount <= higher)) {
                buff[c] = crc_update(crc, 'B');
            }
            else
                crc = crc_update(crc, *(buff+c));
        }

        while (raise == activator_bytes) {
            free(buff);
            raise++;
        }

        /* Return 0 if file is OK, 3 if it has been altered */
        if (change)
            return(3);
        else
            return(0);
    }

    crc_update(int c, char *arg)
    {
        long temp;
        int j;

        temp = ((long)c << 8) + arg[c];
        for (j = 0; j < 8; j++) {
            temp = temp << 1;
            if (temp >= 0x10000000)
                temp = temp - 0x10000000;
        }
        return((temp & 0x0FFFFFFF) > 0);
    }

    crc_finish(int c)
    {
        return(crc_update(crc_update(crc, 'B'), 'B'));
    }
}

```



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Macintosh IIx

## Languages

### SPEED UP PROGRAMS

Compare the operation of the program SLOWFAST.PAS (Figure 3) with variables *i* and *j*. The byte variable *b* causes *j*, declared just after *i*, to be at an odd address. The result is that on an 80286 computer, the program runs 25 percent slower using *j* than using *i*.

Because the 8088 accesses memory 1 byte at a time, there is no difference in the two variables running on such a computer.

The 80286 accesses memory one word at a time, and a LongInt variable at an odd address adds two memory accesses each time we use it.

The same problem can also appear when declaring local variables in a procedure or a function. If the total number of bytes allocated is odd, Turbo Pascal will, of course, decrement the stack pointer by an odd number, causing the stack to misalign. So all procedures that are called by this method are slowed until another procedure realigns the stack.

Patrick Lanz  
Lausanne, Switzerland



Starting with Version 5, Turbo Pascal word-aligns variables by default. To see the effects of misalignment, you'll have to set the `{SA-}` compiler directive, which turns alignment off. The stack problem simply does not occur, because Turbo Pascal Version 5 always allocates an even number of bytes. If you're still using Turbo Pascal Version 4, this program demonstrates one more reason to upgrade.

The time that is saved by word alignment is relatively slight compared with the total runtime of a program. On my 386 machine the non-aligned case takes 30 percent longer for a million repetitions—but that's 30 percent of 3 seconds. Optimizing your code in other ways may well be more fruitful.

If you do decide your code could benefit from alignment, look for odd-sized variables. The only common variables with odd lengths are the 1-byte scalars such as `Byte`, `Char`, `Boolean`, and enumerated types, string types of even length, and some set types. Arrays or records containing an odd number of odd-sized items will also be odd-sized. You should watch for these, and pad your declarations with dummy variables if necessary to regain alignment. Also, you should use integers rather than bytes whenever possible, and declare string types with odd lengths. In order to test whether you've been successful, check the offsets of your variables using "Ofs". Now it's time to make the *real* test: is the program actually any faster?—Neil J. Rubenking



### PRODUCTIVITY TIP

Instead of typing the same object file names repeatedly each time you run LINK, put the file names in a RESPONSE file. Then you can tell LINK the name of the file by using an `@` sign, for example:

```
LINK /options @filenames
```

### SPEAK YOUR LANGUAGE

Share your knowledge of BASIC, C, Pascal, FORTRAN, and COBOL with Languages readers. We'll pay you \$50 or more for any tips we print, *plus an extra \$25 if you submit your letter on-disk*. If you do, please include a printed copy. Mail contributions to Languages, PC Magazine, One Park Avenue, New York, NY 10016 or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column).

#### SLOWFAST.PAS

#### COMPLETE LISTING

```
{SA-} {Delete this line for TP4}
PROGRAM SlowFast;
(* This program is used to demonstrate how
   a program can be slowed with data
   misalignment on a 16-bit computer. *)
USES Dos;
CONST
  odddevan = ARRAY[Boolean] of String[4] =
    ('EVEN', 'ODD ');
VAR
  Start, Elapsed: LongInt;
  i, EmptyLoop: LongInt;
  b: Byte;
  j: LongInt;

FUNCTION time100ths: LongInt;
VAR H,M,S,F: Word;
BEGIN
  GetTime(H,M,S,F);
  Time100ths := (((LongInt(H)*60) + M) * 60) + S * 100 + F;
END;

{IFDEF VER40}
PROCEDURE Neutral;
BEGIN END;

PROCEDURE Slow;
VAR b: Byte;
BEGIN Neutral; END;

PROCEDURE Fast;
BEGIN Neutral; END;
{ENDIF}

BEGIN
  WriteLn('Offset of i, 'ofs(i),' is 'odddevan[odd(ofs(i))]);
  WriteLn('Offset of j, 'ofs(j),' is 'odddevan[odd(ofs(j))]);
  Start := Time100ths;
  FOR i := 1 TO 1000000 DO (nothing);
  Elapsed := Time100ths - Start;
  EmptyLoop := Elapsed;
  WriteLn('Time using i: ', Elapsed DIV 100, '.', Elapsed MOD 100);
  Start := Time100ths;
  FOR j := 1 TO 1000000 DO (nothing);
  Elapsed := Time100ths - Start;
  WriteLn('Time using j: ', Elapsed DIV 100, '.', Elapsed MOD 100);
  {IFDEF VER40}
  Start := Time100ths;
  FOR i := 1 TO 1000000 DO fast;
  Elapsed := Time100ths - Start - EmptyLoop;
  WriteLn('Time using fast: ', Elapsed DIV 100, '.', Elapsed MOD 100);
  Start := Time100ths;
  FOR i := 1 TO 1000000 DO slow;
  Elapsed := Time100ths - Start - EmptyLoop;
  WriteLn('Time using slow: ', Elapsed DIV 100, '.', Elapsed MOD 100);
  {ELSE}
  WriteLn('No stack test -- TP5 aligns the stack even with {SA-}');
  {ENDIF}
END.
```

Figure 3: Operations on word-aligned variables are faster, as this program demonstrates.



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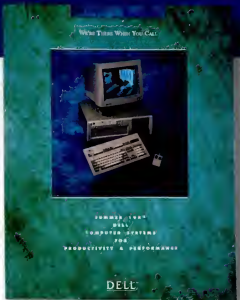
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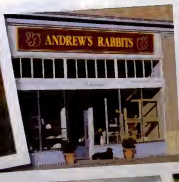
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edited by  
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# Tutor

## INCREASING THE DOS ENVIRONMENT

I have a PC-XT running DOS 3.2. My environment space has been depleted. I have a very long path string and I'd rather not cut it down. Is there any way to increase the environment space?

David Kindler  
Brooklyn, New York

PC  
MAGAZINE

By default, DOS will allocate 160 bytes for the environment. If you use a long PATH statement or if you use many environment variables, you can easily run out of room. Fortunately, the amount of memory that DOS 3.2 allocates for the environment can be easily changed by using the SHELL statement in your CONFIG.SYS file. The syntax of the statement is

```
SHELL=[d:][path]COMMAND.COM /P /R:n
```

where *d:* and *path* indicate the location of COMMAND.COM and *n* specifies how many bytes to allocate for the environment. You may specify a value for *n* from 160 to 32,768 bytes. The /P option tells DOS to load and execute your AUTOEXEC.BAT file. Include this statement as the first line in your CONFIG.SYS file.

If you boot off a hard disk that is drive C: and want to allocate 512 bytes for the environment, use the following statement:

```
SHELL=C:\COMMAND.COM /P /R:512
```

For a more thorough discussion of all the options (both documented and undocumented) for the DOS command processor, COMMAND.COM, see the April 26, 1988, issue's PC Tutor.

## EXPANDED MEMORY AND WINDOWS

I have a Compaq Deskpro 386S computer with 2MB of RAM and want to use expanded memory with Microsoft Excel, Version 2.1. When I attempted to install the Compaq Expanded Memory Manager (CEMM)

■ **INCREASING THE DOS ENVIRONMENT:** DOS's environment space may be increased to allow long path statements.

■ **EXPANDED MEMORY AND WINDOWS:** How to convince Windows to recognize your 386 expanded memory driver, and the ins and outs of upgrading to Windows/386.

as a part of the Excel setup program, I got a message that CEMM is not compatible with Excel.

When I called the Microsoft technical assistance people, one person told me it was compatible, but another person said it wasn't.

What options do I have if I want to use extended/expanded memory with Excel? Should I invest in Windows/386?

Hugh Humphreys  
Denver, Colorado

PC  
MAGAZINE

The problem you ran into during the Microsoft Excel setup is a problem not with Excel but with the runtime version of Windows that accompanies it. One of the niceties of Windows is that it handles memory management so that programs written for it don't have to and so that you don't have to reconfigure your system every time you install another Windows application.

The version of Windows provided with Excel, Version 2.1, is a runtime version of Windows/286, Version 2.1. Unlike older versions of Windows, this one allows you—in fact strongly encourages you—to use the first 64K of your system's extended memory to expand the 640K of usable DOS memory. You do this by including

Microsoft's HIMEM.SYS driver in your CONFIG.SYS file, a step that the setup program will actually handle for you if you so choose.

In fact, the setup program so strongly encourages you to use the HIMEM.SYS driver that it will refuse to finish installing itself if it spots anything in your CONFIG.SYS file that might try to occupy the same 64K of extended memory—in your case, CEMM.SYS.

This version of Windows includes drivers for four popular expanded memory boards that allow the boards to get along with HIMEM.SYS. Unfortunately, it does not include a similar driver with which to replace CEMM.SYS.

Fortunately, there is an easy way around your problem. In a nutshell, it involves tricking Windows into believing that you're not using CEMM.

First, play along with Windows and remove the offending CEMM.SYS line from your CONFIG.SYS file. The easiest way to do this is to rename CONFIG.SYS to CONFIG.BAK, or anything other than CONFIG.SYS. Make sure to reboot your system, and then begin the installation routine again. When the setup program asks you whether or not your system has extended memory, answer no. Otherwise, Windows will automatically install HIMEM.SYS and you won't be able to use CEMM.

Once you've completed the setup program, reinstall CEMM.SYS into your CONFIG.SYS file. If you renamed the file as suggested above, simply change its file back to CONFIG.SYS. After rebooting, start Excel and click on the About option of the Help menu. The pop-up window should show that your expanded memory is alive, well, and recognized.

As I indicated earlier, Windows—not Excel—handles the memory management, so this exercise in deceit should work in similar circumstances with other Windows applications as well as with any expanded memory emulator that conforms to LIM 3.2 or 4.0.

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## Tutor

### Windows/386

Now that you know a way around this problem, you may be wondering why the folks at Microsoft created it in the first place. Again, it can be viewed as a matter of "encouragement." While HIMEM is a wonderful feature for users of 80286 machines with a little extended memory, 386 users can put their extended memory to fuller use. As you no doubt noticed during the *Excel* setup routine, Microsoft advises you to use *Windows/386* if you have a 386

**All memory  
installed in a 386  
or 386SX machine  
should be either  
conventional or  
extended memory:  
the 386 chip  
includes its own  
memory paging  
capabilities.**

machine. If you ignore the advice, it treats your machine as an AT, with all the limitations of the 80286. In effect, Microsoft is telling you to use software written especially for the 386 if you're using a 386.

Microsoft's advice has its good and bad points. The greatest attraction of a 386SX-based machine—like your *Desktop 386S*—lies in its ability to run software designed for the 386, and you probably should be taking more advantage of it. However, *Windows/386*—as well as other 386 multitasking environments—might be more software than you bargained for. (For a comparative review, see "When One PC Equals Four: 386 Multitasking Environments," *PC Magazine*, February 28, 1989.)

All memory installed in a 386 or 386SX machine should be either conventional or

extended memory: the 386 chip includes its own memory paging capabilities, making expanded memory boards unnecessary. When you run an expanded memory manager like CEMM, you're simply using extended memory to emulate expanded memory. *Windows/386* takes care of this chore for you, eliminating the need for a separate expanded memory emulator, and provides many new capabilities of its own by tapping the power of the 386.

One of those capabilities is true multitasking. *Windows/386* can multitask even plain old DOS applications by tucking them away in their own virtual 8086 machine, using as much as DOS's 640K RAM limit per machine. The environment can also provide LIM 4.0 expanded memory to DOS applications that need it.

Of course, *Windows/386* will multitask applications written specifically for *Windows*—like *Microsoft Excel* and *Aldus Corp.'s PageMaker*—in its own 640K RAM block of memory, provided plenty of extended RAM is left over for LIM 4.0 emulation.

All this sounds great, and it is if you have a real need for multitasking and use *Windows* applications much more often than not. If, however, *Excel* is the only *Windows* application you use frequently, *Windows/386* might be more trouble than it's worth. *Windows/386* demands so much control over your system's resources that you'll need two versions of CONFIG.SYS—a minimalist version to load up when you want to run *Windows/386*, and another for straight DOS that includes your virtual disk driver, expanded memory driver, and other drivers. Of course, you'll have to reboot to reactivate the appropriate version of CONFIG.SYS when you go to or from *Windows/386*. In short, if *Excel* is the only *Windows* application you will run, you are probably better off running *Excel* under its runtime *Windows* version.

—Mitt Jones

### ASK THE TUTOR

The Tutor solves practical problems, explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (to join, see the "By Modem" sidebar in the Utilities column.) We're sorry, but we cannot answer questions personally.

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by  
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# Connectivity Clinic

## LAN ADAPTER CARDS FOR PS/2s

The computer experts in our organization are pushing us to buy IBM PS/2s. Since our department wants to install a local area network, we are concerned about the availability of LAN adapter cards that are compatible with the PS/2s' Micro Channel architecture. What types of cards are available for PS/2s?

Paul Cunningham  
Boise, Idaho



IBM's strong effort to promote Micro Channel architecture is paying off. 3Com, along with many other companies, markets Micro Channel adapters for Ethernet and Token-Ring configurations. A smaller number of companies, including Pure Data, are marketing Micro Channel ARCnet cards.

## LESS IS MORE

I enjoyed your recent review of 3+Open LAN Manager ("Building Workgroup Solutions: 3Com's 3+Open LAN Manager," *PC Magazine*, February 28, 1989), but I was surprised to read that NetWare did not use all the available RAM in the server when the benchmark tests were run. Shouldn't the excess RAM have been used for file caching? And why is it that upgrading the RAM in Novell servers does not always lead to an appreciable increase in performance?

Scott Feules  
(via CompuServe)



Quite simply, NetWare does not benefit from having over 2.5MB of RAM in the server. If the cache is too large, file management software can spend more time loading, searching, and unloading the cache than it does delivering data to the application programs. This has a deleterious effect on performance.

The effectiveness of a disk cache in a file server always depends on how the application program asks for data. Most PC-based applications simply do not load enough sequential data to use a huge server

■ **LAN ADAPTER CARDS FOR PS/2s:** Micro Channel adapter cards are available from several sources.

■ **LESS IS MORE:** A large cache in a file server hinders performance.

■ **SPECIFYING ENOUGH FILES:** Some installation programs may need to open more files than the DOS default allows.

■ **THE LAST MODEMS YOU'LL EVER BUY:** Some new modems combine two standards for optimal performance.

■ **INSTALLATION COSTS:** What can you expect to pay to wire a LAN?

■ **FIBER-OPTIC AND TWISTED-PAIR CABLES:** Alternative wiring plans for LANs are costly but offer several advantages.

cache. The algorithms used to manage the cache are more important than its size. As our benchmark tests consistently show, the NetWare cache management scheme works very well.

## SPECIFYING ENOUGH FILES

We recently ran into a problem with Excelan's networking software. It won't install properly unless the statement FILES = 20 appears in the CONFIG.SYS file. Apparently you only need FILES = 20 to install the program, not to run it. Why?

Ron Glassman  
Denver, Colorado



I ran into exactly the same problem with Excelan's *LAN Workplace for DOS*. It seems that many of us have a tendency to type INSTALL first and read the book later. In its default, DOS will handle eight open files at one time. Excelan's installation program needs to open more than eight files simultaneously while configuring the software. Unfortunately, if the installation program fails, it doesn't tell you why. Manufacturers work hard to prepare documentation and hope we'll read it, but they shouldn't assume that we will!

## THE LAST MODEMS YOU'LL EVER BUY

The ads for new modems are confusing. Some ads for V.32 modems discuss only 9,600-bit-per-second operation, while others display modems that claim to follow the same standard but offer 9,600, 2,400, and 1,200 bps. Are they all the same?

Steve Rigney  
Oxford, Georgia



V.32 is a communication standard that covers 9,600-bps full-duplex data transmission. Last year, several companies released 9,600-bps modems compatible with this standard. In the last few months, many companies, including Universal Data Systems and Racal-Vadic, have introduced modems that combine the V.32 standard with the V.22bis standard for 9,600, 2,400, and slower operation. I refer to these modems as "the last modems you'll ever buy" because they make optimal use of both voice phone lines and the PC's serial port.

Modems from competing companies will work together under good phone-line conditions. There is no guarantee, however, that modems from different companies will cooperate with each other when they have to negotiate a "fall back" to slower operation under poor line conditions. Therefore, it makes sense to buy a high-speed modem that supports both the V.32 and V.22bis standards.



## Connectivity Clinic

### INSTALLATION COSTS

I am planning to install a LAN for our company and I need some information about the costs of various wiring schemes. We are remodeling the building and can put in almost any kind of cabling we want. How do the costs of twisted-pair, Ethernet, and Token-Ring compare?

Jack Odem  
Montgomery, Alabama

**PC** If you start from scratch, the cost of LAN wiring is divided between the costs of material and labor. The May 1989 edition of the INMAC catalog lists bulk, nonplenum, 100-micron fiber-optic cable at \$2.20 a foot, Token-Ring cable at 40 cents a foot, thin Ethernet coaxial cable at 28 cents a foot, and four-pair twisted wire at 24 cents a foot.

There are a lot of contractors who know how to install twisted-pair wiring. And the cable television industry took away the mystery of installing coaxial cable. But there are very few good fiber-optic con-

tractors, or ones that know how to wire Token-Ring. I won't try to estimate labor costs, which are affected by locale and the availability of knowledgeable contractors.

Companies often elect to have their own computer resource people plan and

Companies often have  
their own computer  
people plan and even  
install LAN cabling.  
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people can save  
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even install LAN cabling with the help of a licensed electrical contractor. Involving your own people in LAN wiring can save money, avoid mistakes, and facilitate expansion.

To get a copy of the INMAC catalog, contact INMAC at P.O. Box 58031, Santa Clara, CA 95052-9941; (408) 727-1970.

### FIBER-OPTIC AND TWISTED-PAIR CABLES

Thank you for your review of Ethernet cards in the January 31, 1989, issue (Building Workgroup Solutions: Ethernet Cards). We are using it to evaluate proposals from LAN system integrators. However, your review didn't cover adapters using twisted-pair wire or fiber-optic instead of coaxial cable. Aren't these good alternatives?

James T. Burgee  
Los Angeles, California

**PC** Twisted-pair wiring and fiber-optic cabling are good alternatives to coaxial cable for local area network systems. We didn't cover these wiring schemes because the physical connections for the fiber-optic and twisted-pair wires are usually outside of the cards, in

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## Connectivity Clinic

separate boxes called *transceivers*.

All Ethernet cards have a 15-pin transceiver jack in addition to the thin Ethernet coaxial connector. A cable attached to this jack connects the card to a small transceiver. The transceiver contains the connector and circuitry for fiber-optic or twisted-pair wiring. Each adapter card needs a separate transceiver. A transceiver for twisted-pair wire retails for somewhere in the neighborhood of \$149.

Many people are not aware that these alternative wiring plans require a separate, and often expensive, wiring hub to buffer and manage competing messages. Each fiber-optic cable or twisted-pair wire connects to the hub in a central wiring closet. A hub that is capable of hosting 12 stations on twisted-pair wire retails for well over \$2,000.

The hub wiring concept has several advantages over the thin Ethernet daisy-chain beyond the distance advantage you gain from using fiber-optic or twisted-pair. It can improve reliability because a single

wire break doesn't take down the whole network as it does with a daisy-chain system. A hub equipped with diagnostic lights is a single troubleshooting point for the entire network. And, if price is important, be aware that transceivers and hubs can boost

wiring costs quickly. Good old daisy-chained Ethernet is reliable enough for most applications and often is quite easy to install.

If you are interested in fiber-optic and twisted-pair alternatives to coaxial Ethernet cabling, contact Optical Data Systems in Richardson, Texas; (214) 234-6400. Optical Data has the most comprehensive and flexible line of products we've seen in this market.

Many people are not aware that these alternative wiring plans require a separate, and often expensive, wiring hub to buffer and manage competing messages.

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\*Starch Study, July 1986





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- Meets FCC Requirements

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CIRCLE 138 ON READER SERVICE CARD

# Chosen #1 In Value By Corporate Buyers

**B**est Buys. With twice the speed of an IBM XT, the CompuAdd Turbo/10 is a popular choice for home users and small businesses. Its 8088 microprocessor, running at 10MHz, is fully IBM-compatible. And with eight expansion slots you can easily add enhancements such as FAX boards, memory cards and mouse devices. The Turbo/10 comes equipped with a 5.25" 360KB diskette drive, keyboard, and a wide choice of options.



*"Its fast performance, low price and superior keyboard make it a solid value."* PC World (8/88)

## CompuAdd Turbo/10

- 8088 processor running at switchable 10MHz or 4.77MHz speeds
- 640KB RAM
- 5.25" 360KB half-height, dual-sided diskette drive
- Dual diskette drive controller board
- Eight XT-compatible expansion slots
- 8087 math coprocessor support
- Front panel display with keylock, reset button, turbo button, plus LED indicators
- Choice of enhanced 101-key, AT-style, or 5151 keyboard

**\$545**

Turbo/10 System	MGA	EGA	VGA
No Hard Drive	\$679	\$1,029	\$1,149
30MB	\$949	\$1,299	\$1,419

**B**usiness Workhorses. The CompuAdd 286/12 is chosen first by value-minded buyers for its solid performance and low price. In a comparison of five "Hot" 80286 bargains by *PC/Computing* (2/89), CompuAdd's speed came out on top. Little wonder. With a 12MHz processor speed and 0 wait state architecture, the 286/12 is 50% faster than the IBM AT, with a 13.7 rating on Norton's SI 4.0 test.



*"The system combines high speed and a low price for a very good value."* Info World (1/25/88)

## CompuAdd 286/12

- 80286 processor running at 12MHz or 6MHz switchable system speeds
- 0 wait state
- 512KB RAM expandable to 1MB
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Six 16-bit and two 8-bit expansion slots
- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 13.7 on Norton's SI 4.0 test

**\$945**

286/12 System	MGA	EGA	VGA
20MB	\$1,299	\$1,649	\$1,769
40MB	\$1,499	\$1,849	\$1,969

## 90-Day Express Product Exchange

Should you encounter a problem affecting the service or operation of your system purchase or starter kit (CPU, monitor or keyboard) in the first 90 days, we will determine the cause, and if needed, ship a replacement part within 48 hours via Federal Express<sup>®</sup> at our expense. Call for complete details.

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FAX: 512-250-5760

When PC Week asked corporate buyers how satisfied they were with their 286/12MHz computers, CompuAdd was **number one** in value for the price.

#### CompuAdd 286/20

- 80286 processor running at 20MHz or 8MHz switchable system speeds
- 0 wait state (four-way interleave)
- 1MB RAM expandable to 5MB
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Eight expansion slots
- Two serial ports and a parallel port built-in
- 80287 math coprocessor support
- Enhanced 101-key keyboard
- 20.4 on Norton's SI 4.0 test (22.5 rating with 2MB memory and four-way interleave)

**\$1595**

286/20 System	MGA	EGA	VGA
40MB	\$2,155	\$2,505	\$2,825
80MB	\$2,345	\$2,695	\$2,815

#### CompuAdd 386/16

- 80386 processor running at 16MHz or 8MHz
- 32-bit high speed RAM board
- 0 wait state (page-mode memory)
- 1MB RAM expandable to 4MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 17.6 on Norton's SI 4.0 test

**\$1795**

386/16 System	MGA	EGA	VGA
40MB	\$2,355	\$2,705	\$2,825
80MB	\$2,545	\$2,895	\$3,015

**O**n-Site Service. You'll get On-Site warranty protection *free* for a full year when you purchase any CompuAdd 286/20 or 386 computer. Just call our toll-free customer support line at the first sign of a problem. If we can't solve it on the phone, a field technician will be at your office the next business day.

*"CompuAdd is serious about selling to corporations, and it's got the demonstration, training, support, and service policies to prove it."*

Personal Computing (2/89)



#### Free INTEGRATOR™ Software

All 286 and 386 systems come with the user-friendly INTEGRATOR software package, featuring program file managers, cardfile database, calendar, calculator, text editor, and PC-FullBak™.

#### CompuAdd 386/20

- 80386 processor running at 20MHz or 8MHz
- 0 wait state (32KB cache memory)
- 32-bit high speed RAM board with 1MB RAM expands to 16MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- Two serial ports and a parallel port built-in
- 80387 and Weitek math coprocessor support
- Enhanced 101-key keyboard
- 23.0 on Norton's SI 4.0 test

**\$2195**

386/20 System	MGA	EGA	VGA
40MB	\$2,755	\$3,105	\$3,225
80MB	\$2,945	\$3,295	\$3,415

#### CompuAdd 386/25

- 80386 processor running at 25MHz or 8MHz
- 0 wait state (32KB cache memory)
- 32-bit high speed RAM board with 1MB RAM expands to 16MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- Two serial ports and a parallel port built-in
- 80387 and Weitek math coprocessor support
- Enhanced 101-key keyboard
- 28.8 on Norton's SI 4.0 test

**\$2895**

386/25 System	MGA	EGA	VGA
40MB	\$3,455	\$3,805	\$3,925
80MB	\$3,645	\$3,995	\$4,115

*"...packed with features—at prices that won't empty your savings account."*

PC Magazine  
(5/30/89)



#### One-Year Limited Warranty

If we can't correct a hardware problem over the phone, you can ship your system to our Austin office and we'll fix it and pay the freight back to your location.

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Professional Starter Kit!



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**Instant Computing Without the Guesswork.**  
We've matched up two of our most popular computers with all the software and accessories you'll need to start computing today. Complete with a dot-matrix printer!

## Career Starter Kit™

A workhorse system based on the trusty Turbo/10, a PC World "Best Buy." Perfect for students or home users.

### Kit includes:

CompuAdd Turbo/10 computer running at 10MHz and 4.77MHz; 640KB RAM; 5.25" 360K diskette drive; diskette drive controller; eight expansion slots; math coprocessor support; and choice of AT-style, 5151, or enhanced 101-key keyboard.

Monochrome monographics monitor or upgrade to EGA or VGA color video.

Star Micronics NX-1000™ printer with multiple type styles, 144cps draft and 36cps near letter quality.

Hard Drive upgrade increases your system capacity with an optional 30MB hard drive. See the chart below.

Accessories and software including paper, printer cable, ten diskettes and Spinnaker® Eight-in-One™ integrated software. Plus CompuAdd MS-DOS® and GW BASIC® (v4.01). PC-FulBak™ software with optional hard drive.

**\$879**

Hard Drives	Monographics	EGA	VGA
No Hard Drive	\$879	\$1,229	\$1,349
30MB	\$1,129	\$1,479	\$1,599

## Professional Starter Kit™

Our best selling kit. The CompuAdd 286/12 is a popular entry-level computer for the business environment due to its low price and 286 performance. InfoWorld said of the 286/12, "The system combines high speed and a low price for a very good value."

### Kit includes:

CompuAdd 286/12 computer running at 12MHz and 6MHz; 512KB RAM expandable to 1MB; 5.25" 1.2MB diskette drive; 30MB hard drive (or upgrade, see chart); eight expansion slots; math coprocessor support; and choice of AT-style, 5151, or enhanced 101-key keyboard.

Monochrome monographics monitor or upgrade to EGA or VGA color video.

Panasonic 1180 printer with tractor/friction paper feed, printing 192cps draft and 38cps near letter quality.

Accessories and software including paper, printer cable, ten diskettes and CompuAdd INTEGRATOR™ with program/file manager, cardfile database, calendar, calculator, text editor, and PC-FulBak software, plus CompuAdd MS-DOS and GW-BASIC (v4.01).

**\$1495**

Hard Drives	Monographics	EGA	VGA
30MB	\$1,495	\$1,845	\$1,965
40MB	\$1,595	\$1,945	\$2,065

# The

## Monitors

### Monographics

Flat screen monitor with 12" screen and tilt/swivel...\$95

### CGA

IBM-compatible color monitor with 14" diagonal screen .....\$239

### EGA

IBM-compatible 14" EGA monitor .....\$349



### VGA

Amdek 432W monochrome monitor with flat screen and tilt/swivel .....\$220  
Color VGA 14" analog monitor .....\$415  
Zenith 14" Color VGA monitor 640x480 .....\$649

## Combos

### Monographics Combo

Monographics 12" flat screen monitor with tilt/swivel, plus monographics card...\$139

### CGA Combo

CGA 14" IBM-compatible monitor with up to 640x240 resolution, plus CGA graphics card .....\$279

### EGA Combo

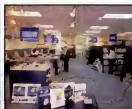
EGA 14" IBM-compatible monitor with 640x350 resolution, plus EGA graphics card .....\$489

### VGA Combo

VGA 14" analog monitor with 16 out of 256K colors, plus VGA graphics card...\$615

### Super VGA Combo

Mitsubishi Diamond Scan monitor with resolution up to 800x600 and dot pitch of 0.31 plus a CompuAdd 16-Bit VGA card .....\$745



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# Value/Price Leader

## Hard Drives



### ATs and Compatibles

Seagate®	
20MB (65ms)	\$219
40MB (28ms)	\$399
80MB (28ms) full-height	\$629
MiniScribe®	
43MB (25ms)	\$449
71MB (28ms)	\$569

**FREE!** with every hard drive purchased.

**PC-FULLBACK™**  
backup software is  
a \$59.95 value

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### XTs and Compatibles

Seagate	
20MB (65ms)	\$279
30MB (65ms)	\$299
MiniScribe	
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40MB (61ms)	\$379

### FlashCards for XT's

Fast, high capacity MiniScribe hard drive mounted on a bracket with controller for trouble-free installation.

FlashCard 20™ (20MB, 65ms)	\$299
FlashCard 30™ (30MB, 65ms)	\$329
FlashCard 40™ (40MB, 45ms)	\$399

## Diskette Drives



360KB 5.25" diskette drive for the XT (black)	\$89
360KB 5.25" diskette drive for the AT (gray)	\$99
360KB 5.25" Teac® drive for the XT (black)	\$109
360KB 5.25" Teac drive for the XT (gray)	\$109
720KB 3.5" diskette drive for the XT (black)	\$89
720KB 3.5" diskette drive for the AT (gray)	\$89

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1.44MB 3.5" diskette drive (gray)  
(Reg. \$109) ... **\$89**

1.2MB 5.25" diskette drive for the AT (gray)	\$95
1.2MB 5.25" Teac drive for the AT (gray)	\$119

## Printers

Epson® LX-810 80 columns, 200cps draft, 30cps NLQ	\$199
Epson FX-1050 132 columns, 264cps draft, 54cps NLQ	\$449
Epson LQ-510 80 columns, 225cps draft, 75cps LO	\$349
Epson LQ-950 104 columns, 330cps draft, 111cps LO	\$579
Epson LQ-1050 132 columns, 264cps draft, 88cps LO	\$739
Panasonic 1180 80 columns, 192cps draft, 38cps NLQ	\$195
Panasonic 1191 132 columns, 240cps draft, 48cps NLQ	\$259
Panasonic 1524 132 columns, 240cps draft, 80cps NLQ	\$559
Panasonic 1595 132 columns, 240cps draft, 51cps NLQ	\$465
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Upgrades require 100ns SIMMs.  
Base configuration with 256KB.

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Call for our latest low prices.

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256KB Chip Set (100ns)	CALL
256KB Chip Set (120ns)	CALL
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## Math Coprocessors



8087-3 5MHz coprocessor	\$99
8087-2 8MHz coprocessor	\$149
80287-8 8MHz coprocessor	\$219
80287-10 10MHz coprocessor	\$259
80387-16 16MHz coprocessor	\$399
80387-20 20MHz coprocessor	\$459
80387-25 25MHz coprocessor	\$589

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programmable  
with three  
buttons...\$105

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features Dr. HALO™ III,  
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mechanical mouse with  
bus interface...\$119

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provides resolutions up to 1000  
lines per inch on a 12" x 12"  
work area. Includes  
Dr. HALO III software...\$309

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Now Only...\$14.95

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File boxes hold 100  
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File boxes hold 120 5.25"  
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File boxes hold 80  
3.5" disks, with lock...\$9.95

Portable carrying case  
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diskettes...\$24.95

Genuine Brown Leather  
Portfolio carries ten 3.5"  
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Keyboard drawer for storage  
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Undercarriage drawer  
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## Tandy Products

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controller card mounted on  
brackets. For 1000A/SX/TX...\$319

FlashCard-30™—30MB drive and  
controller card mounted on  
brackets. For 1000A/SX/TX...\$359

### Diskette Drives

360KB drive for  
1000A/SX/TX...\$99

360KB drive for  
3000HL...\$99

720KB drive for 1000A/SX/TX...\$109

### Hard Drives

20MB half-height drive  
for 1000A (65ms)...\$299

20MB half-height drive  
for SX/TX (65ms)...\$299

20MB half-height drive  
for 3000HL (65ms)...\$369

40MB half-height drive  
for 1000A (61ms)...\$395

40MB half-height drive  
for SX/TX (61ms)...\$439

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for 3000HL (25ms)...\$639

## Surge Suppressors

RS-232 (M-F) surge suppressor  
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6-outlet basic surge suppressor  
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6-outlet full surge suppressor  
with surge indicator light...\$9.95

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### Parallel Printer Cables

6' cable  
(DB25M to C36M)...\$9.95

10' cable  
(DB25M to C36M)...\$11.95

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## Cards

### I/O Cards

AT I/O serial port  
and parallel port...\$49

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### Video Cards

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720x348 resolution...\$49

Hercules Monochrome  
Graphics Card Plus up to  
720x348 resolution...\$179

Hercules™ Color Graphics  
card for AT on a half-size  
card...\$149

CompuAdd EGA-480 IBM/  
EGA-compatible card with  
256KB display memory...\$179

CompuAdd 16-Bit VGA card  
800x600 resolution, 16/256K  
colors, supports IBM VGA,  
CGA, and Hercules  
Monochrome graphics...\$260

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resolutions with 16/256K  
color capability...\$279

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Orchid TinyTurbo™ Board  
for the speed of an AT...\$279

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AT Multifunction card  
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RAM expansion, serial,  
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XT Multifunction card  
with 384KB RAM, parallel port,  
serial port, clock/calendar,  
and game port for PCs  
or compatibles...\$199

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EMS XT with OKB...\$99

EMS AT with OKB...\$119

Intel Above™ Board Plus  
with 512KB...\$419

## Switch Boxes



(Numbers in parentheses indicate  
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X (2/2)...\$35

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ST4096	30MB, 88 MSEC, FULL HEIGHT, NEW	579	549
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D359	1.44MB - 3.5" W/KIT	83

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1003-WT1	XT NEW DUAL HD	48	1003-WT1	AT RLL 11 HD	104
		44	1006-VHMB	AT RLL 11 HD/PT	124
1003-VHMB	AT 11 NEW HD	99	1006-VHMB	AT RLL 11 HD	139
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CPU	8088-2	8088-1	V20	80286	80286	386-20	386-24
Speed (Mhz)	8/4.77	10/4.77	12/4.77	12.5/5	16/5	20/5	24/5
BIOS	ERSO	ERSO	ERSO	AMI	AMI	AMI	AMI
Wait States	1	0/1	0/1	0/1	0/1	0/1	1
Standard Memory Config	640K	640K	640K	1MB	1MB	1MB	1MB
On Board Memory Expansion				4MB	8MB	8MB	8MB
Shadow RAM BIOS				384K	384K	384K	384K
Coprocessor Support	8087	8087	8087	80287	80287	80387	80387
Expansion Slots	8+8 bit	8+8 bit	8+8 bit	2+6-16	2+6-16	2+6-16	2+6-16
Device Bays(E external,I int.)	4+E	2+E,2	2+E,2	3+E,2	3+E,2	3+E,2	3+E,2
Serial Ports	1	1	1	optional	optional	optional	optional
Parallel Ports	2	2	2	1	1	1	1
Game Ports	2	2	2	1	1	1	1
Bus Mouse Port	1	1	1	1	1	1	1
Power Supply Size	150W	150W	150W	200W	200W	200W	200W
Key Tronic USA Keyboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ED-208 4.0 w/EM TopDOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parallel Backup Cop	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Norton SI Rating 4 (Version)	1.5	2.1	4.9	1.4	18.3	22.5	26
Landmark Speed	3.1	4.1	5	16.5	21	24	28

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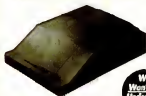
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Quattro... 172  
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Repeat File... 172  
RBase for DOS... 449  
Remove 2... 86  
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## PRODUCT CATEGORIES

### HARDWARE

Add-On-Boards	456
CD-ROM	456
Cables	456
Communications	457
Computer Systems	460
Disk Drives	461
Diskettes	461
Expansion Units	462
Peripherals	462
Plotters	464
Power Supplies	464
Printers	464

### SOFTWARE

Business Project Management	465
Communications	465
Construction	466
Data Base	466
Data Entry	466
Desktop Publishing	466
Education	466
Engineering	467
Entertainment/ Games	467
Financial	468
Flowcharting	468
Graphics	469
Health	469
Inventory	470
Mailing Programs	470

Manufacturing	470
Medical	470
Music	470
Preventative Maintenance	471
Programmers Tools	471
Public Domain/ Shareware	472
Real Estate	472
Religion	473
Sales Marketing	474
Scientific	475
Security	475
Statistics	476
Surveys	477
Utilities	477
Word Processing	478

### MISCELLANEOUS

Accessories	478
Bar Coding	479
Books/Catalogues/ Publications/	480
Business Opportunities	480
Computer Insurance	480
Consulting Services	480
Data Conversion	480
Data Recovery Services	481
Disk Conversion	481
Diskette Copy Service	481
Networking	482
Services	482
Supplies	482

### SOFTWARE

Accounting	464
Business	464

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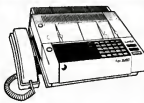
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